MUNGASAJI MAHARAJ MAHAVIDYALAYA, DARWHA

3.3.2.1. Number of research papers in the Journals notified on UGC website during the last five years

Year	2016-17	2017-18	2018-19	2019-20	2020-21
Number	09	21	45	04	09

	Key Indicator - 3.3 Research Publications and Awards (25)						
	3.3.2 Number of research papers per teachers in the Journals notified on UGC website during the last five years (10)						
	Title of paper	**Name of the author/s**	**Department of the teacher**	**Name of journal**	**Year of publication**	**ISSN number**	**Link to the recognition in UGC enlistment of the Journal**
1	Kaluza Klein Cosmological models with dark energy & special form of deceleration parameter	Dr.V.B.Raut	Mathematics	International Journal of Scientific & Engineering Research	2016	2229-5518	
2	Bianchi Type –III dark energy cosmological Models in FR Theory of Gravitation	Dr.V.B.Raut	Mathematics	European International Journal of Science & Technology		2304-9693	
3	Evolution of new 2-N-tert.butyl-5-aryl-1,3,4-oxidiazol-2-amine for antimicrobial activity	Dr.N.A.Rashidi	Chemistry	Research Journal .Chem.Sci	2016	2231-606	

4	Synthesis & De-tert,butylation of 2-arylimino-5-Tert.butylimino-1,3,4-Thiadiazolidines	Dr.N.A.Rashidi	Chemistry	Int.Jouranl of pharmaceutical & Chemical science	2016	2227-5005	
5	Synthesis of 2-arylimino-5-Tert.butylimino-1,3,4-Thiadiazolidines	Dr.N.A.Rashidi	Chemistry	Int.Journal of Pharma & Chemical Research	2016	2395-3411	
6	Effect of Isotonic & Isometric Training on the Performance of College going girls	Prof.S.A. Dambhare	Physical Education	An International Journal of Contemporary Studies	2017	Peer reviewed	
7	Olympic: A Perspective	Prof.S.A.Dambhare	Physical Education	Global Journal of Applied Social , Political & Sports Science Multidicsiplinary Journal	2016	2278-4284	
8	Goods & Service Tax	Dr.M.N.Moharil	Commerce	Intenational Journal			
9	Two fluid dark energy Cosmological model In saez- Ballester theory of gravitation	Dr Y.S. solanke	Mathematics	IJMAIA, 62807 UGC Approved Journal	Jan 2017	2347-1557	

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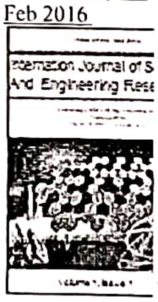

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KALUZA-KLEIN COSMOLOGICAL MODELS WITH ANISOTROPIC DARK ENERGY AND SPECIAL FORM OF DECELERATION PARAMETER

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Abstract: The exact solutions of the Einstein field equations for dark energy in Kaluza-Klein metric under the assumption on the anisotropy of the fluid are obtained by applying special form of deceleration parameter in General Relativity. The geometrical and physical aspect of the model is also studied.

Keywords: Kaluza- Klein space-time, Anisotropic Fluid, Dark Energy, Isotropization, Special form of deceleration parameter.

Introduction:

Recent most remarkable observational discoveries have shown that our universe is currently accelerating [1] and confirmed later by cross checks from the cosmic microwave background radiation and large scale structure [2, 3] strongly suggest that the Universe is spatially flat and dominated by an exotic component with large negative pressure, referred to as dark energy [4]. The first year result of the Wilkinson Microwave Anisotropy Probe (WMAP) shows that dark energy occupies about 73% of the energy of our Universe, and dark matter about 23%. The usual baryon matter which can be described by our known particle theory occupies only about 4% of the total energy of the Universe.

Today we can examine not only when the cosmic acceleration began and the current value of the deceleration parameter, but also how the acceleration (the deceleration parameter) varies with time. After the discovery of the late time acceleration of the universe, many authors have used CDP to obtain cosmological models in the context of dark energy (DE) in general relativity and some other modified theories of gravitation such as f(R) theory within the framework of spatially isotropic and anisotropic space-times. However, generalizing CDP assumption would allow us to construct more precise cosmological models.

Many authors [9], [10] proposed a linearly varying deceleration parameter (LVDP), which can be used in obtaining accelerating cosmological solutions. As a special case, LVDP also covers the special law of variation for Hubble parameter, which yields constant deceleration parameter (CDP) models of the universe, presented by Berman [11, 12] and references therein.

By choosing a particular form of the deceleration parameter q, which gives an early deceleration and late time acceleration for dust dominated model, [13] shows that this sign flip in q can be obtained by a simple trigonometric potential.

The quintessence model [14] with a minimally coupled scalar field by taking a special form of decelerating parameter q in such a way that which provides an early deceleration and late time acceleration for borotropic fluid and Chaplygin gas dominated models.

Motivated from the studies outlined above we choose a form of q as a function of the scale factor a so that it has the desired property of a signature flip.

In the present paper, Kaluza-Klein cosmological models with anisotropic dark energy and special form of deceleration parameter have been studied. To have a general description of an anisotropic dark energy component, we consider a phenomenological parameterization of dark energy in terms of its Equation of State (ω) and skewness parameter (δ). The exact solutions of the Einstein field equations have been obtained by applying special form of deceleration parameter. Some features of the evolution of the metric and the dynamics of the anisotropic DE fluid have been examined

2. Metric and Field equations:

The Kaluza-Klein type metric is given by

$$ds^2 = dt^2 - a^2\left(dx^2 + dy^2 + dz^2\right) - b^2 d\psi^2 \quad , \tag{1}$$

where a and b are functions of cosmic time t only.

Here we are dealing only with an anisotropic fluid whose energy-momentum tensor is in the following form

$$T_v^u = diag\left[T_0^0, T_1^1, T_2^2, T_3^3, T_4^4\right] \quad .$$

We parametrize it as follows:

$$T_v^u = diag\left[\rho, -p_x, -p_y, -p_z, -p_\psi\right] = diag\left[1, -\omega_x, -\omega_y, -\omega_z, \omega_\psi\right]\rho \quad ,$$

where ρ is the energy density of the fluid; p_x, p_y, p_z and p_ψ are the pressures and $\omega_x, \omega_y, \omega_z$ and ω_ψ are the directional equation of state (EoS) parameters of the fluid.

Now, parametrizing the deviation from isotropy by setting $\omega_x = \omega_y = \omega_z = \omega$ and then introducing skewness parameter δ that is the deviation from ω on ψ-axis. Here ω and δ are not necessarily constants and can be functions of the cosmic time t.

The parametrized energy-momentum tensor is

$$T_\upsilon^\mu = diag[1, -\omega, -\omega, -\omega - (\omega + \delta)]\rho \quad . \tag{2}$$

The Einstein field equations, in natural limits ($8\pi G = 1$ and $c = 1$) are

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = -T_{\mu\nu} \quad , \tag{3}$$

where $g_{\mu\nu}u^\mu u^\nu = 1; u^\mu = (1,0,0,0,0)$ is the velocity vector; $R_{\mu\nu}$ is the Ricci tensor; R is the Ricci scalar, $T_{\mu\nu}$ is the energy-momentum tensor.

In a co-moving coordinate system, Einstein's field equations (3), for the anisotropic Kaluza-Klein space-time (1), with equation (2) yield

$$3\frac{\dot{a}\dot{b}}{ab} + 3\frac{\dot{a}^2}{a^2} = \rho \tag{4}$$

$$2\frac{\ddot{a}}{a} + \frac{\ddot{b}}{b} + \frac{\dot{a}^2}{a^2} + 2\frac{\dot{a}\dot{b}}{ab} = -\omega\rho \tag{5}$$

$$3\frac{\ddot{a}}{a} + 3\frac{\dot{a}^2}{a^2} = -(\omega + \delta)\rho \tag{6}$$

where the overhead dot ($\cdot$) denote derivative with respect to the cosmic time t.

3. Isotropization and the solution:

There are three linearly independent equations (4)-(6) with five unknowns a, b, ρ, ω and δ. In order to solve the system completely we impose a s pecial form of deceleration parameter as

$$q = -\frac{\ddot{R}R}{\dot{R}^2} = -1 + \frac{\alpha}{1 + R^\alpha} \, . \tag{7}$$

where R is mean scale factor of the universe , α (> 0) is constant. This low has been recently proposed by Singha and Debnath (2009) [14] for FRW metric. From figure (i) we have seen that q decreases from $+1$ to -1 for evolution of the universe. Recently, Adhav et al. [31] has extended this law for Bianchi type-I, III, V, VIo and

Kantowski-Sachs cosmological models with dynamical equation of state (EoS) parameter.

From (7) after integrating, we obtain the Hubble parameter as

$$H = \frac{\dot{R}}{R} = m\left(1 + R^{-\alpha}\right) \quad , \tag{8}$$

where m is an arbitrary constant of integration.

Here we assume the deceleration parameter as given in (3.1) (7), which can be integrated twice to give $H = \frac{\dot{R}}{R}$ as in equation (3.2) (8) and the average scale factor as

$$R = (e^{m\alpha t} - 1)^{\frac{1}{\alpha}} \quad . \tag{9}$$

The ~~spatial volume is given by~~

$$V = R^4 = a^3 b \, . \tag{10}$$

i.e. $$V = a^3 b = \left(e^{m\alpha t} - 1\right)^{\frac{4}{\alpha}} \tag{11}$$

The directional Hubble parameters in the direction of x, y, z and ψ respectively for the Kaluza- Klein metric are

$$H_x = H_y = H_z = \frac{\dot{a}}{a}, \text{ and } H_\psi = \frac{\dot{b}}{b} \tag{12}$$

The mean Hubble parameter is given as

$$H = \frac{\dot{R}}{R} = \frac{1}{4}\frac{\dot{V}}{V} = \frac{1}{4}\left(3\frac{\dot{a}}{a} + \frac{\dot{b}}{b}\right) \, . \tag{13}$$

Subtracting equation (5) from equation (6), we get

$$\frac{d}{dt}\left(\frac{\dot{a}}{a} - \frac{\dot{b}}{b}\right) + \left(\frac{\dot{a}}{a} - \frac{\dot{b}}{b}\right)\frac{\dot{V}}{V} = -\delta\rho \ .$$

Which on integrating gives

$$\left(\frac{\dot{a}}{a}-\frac{\dot{b}}{b}\right)=\frac{\lambda}{V}\quad e^{\int \frac{\delta \rho}{\left(\frac{\dot{b}}{b}-\frac{\dot{a}}{a}\right)}dt}, \tag{14}$$

where λ is positive constant of integration.

In order to solve the above equation (14) we use the condition

$$\delta=\frac{\left(\frac{\dot{b}}{b}-\frac{\dot{a}}{a}\right)m\alpha}{\rho} \tag{15}$$

Using equation (15) in the equation (14), we obtain

$$\left(\frac{\dot{a}}{a}-\frac{\dot{b}}{b}\right)=\frac{\lambda}{V}e^{m\alpha t}. \tag{16}$$

Using equation (11) in equation (16) and then integrating we get the scale factors as

$$a(t)=\left(e^{m\alpha t}-1\right)^{\frac{1}{\alpha}}\exp\left\{\frac{\lambda}{4m(\alpha-4)}\left(e^{m\alpha t}-1\right)^{\frac{\alpha-4}{\alpha}}\right\} \tag{17}$$

$$b(t)=\left(e^{m\alpha t}-1\right)^{\frac{1}{\alpha}}\exp\left\{-\frac{3\lambda}{4m(\alpha-4)}\left(e^{m\alpha t}-1\right)^{\frac{\alpha-4}{\alpha}}\right\}. \tag{18}$$

4. Physical behavior of the model:

Using equations (17) and (18) the directional Hubble parameters are found as

$$H_x=H_y=H_z=\frac{\dot{a}}{a}=\frac{\lambda}{4}e^{m\alpha t}\left(e^{m\alpha t}-1\right)^{\frac{-4}{\alpha}}+m\left(1-e^{-m\alpha t}\right)^{-1}. \tag{19}$$

And $$H_\psi=\frac{\dot{b}}{b}=-\frac{3\lambda}{4}e^{m\alpha t}\left(e^{m\alpha t}-1\right)^{\frac{-4}{\alpha}}+m\left(1-e^{-m\alpha t}\right)^{-1}. \tag{20}$$

The mean Hubble parameter H for Kaluza-Klein metric may given by

$$H=\frac{m}{\left(1-e^{-m\alpha t}\right)}. \tag{21}$$

The anisotropic parameter of the expansion (Δ) is defined as

$$\Delta\equiv\frac{1}{4}\sum_{i=1}^{4}\left(\frac{H_i-H}{H}\right)^2,$$

where $H_i, (i = 1,2,3,4)$ represent the directional Hubble parameters in the directions of x, y, z and ψ respectively and is found as

$$\Delta = \frac{3\lambda^2}{16m^2}\left(e^{m\alpha t} - 1\right)^{\frac{2(\alpha-4)}{\alpha}} \quad . \tag{22}$$

The expansion scalar θ is given by

$$\theta = 4H = \frac{4m}{\left(1 - e^{-m\alpha t}\right)}. \tag{23}$$

The shear scalar σ^2 is given by

$$\sigma^2 = \frac{1}{2}\left(\sum_{i=1}^{4} H_i^2 - 4H^2\right) = \frac{4}{2}\Delta H^2$$

$$= \frac{3\lambda^2}{8} e^{-2m(4-\alpha)t}\left(1 - e^{-m\alpha t}\right)^{\frac{-8}{\alpha}} . \tag{24}$$

Using equations (19) and (20) in equation (4), we obtain the energy density for the model as

$$\rho = \left[6m^2(1 - e^{-m\alpha t})^{-2} - \frac{3\lambda^2}{8} e^{-2m(4-\alpha)t}(1 - e^{-m\alpha t})^{\frac{-8}{\alpha}}\right] \tag{25}$$

Using equations (25) in equation (15), we obtain the deviation parameter as

$$\delta = -\left\{\frac{m\alpha\lambda\, e^{-m(4-\alpha)t}}{6m^2(1 - e^{-m\alpha t})^{\frac{4}{\alpha}-2} - \frac{3\lambda^2}{8} e^{-2m(4-\alpha)t}(1 - e^{-m\alpha t})^{\frac{-4}{\alpha}}}\right\} . \tag{26}$$

Using equations (17), (19), (25) and (26) in equation (6), we obtain the deviation-free parameter as

$$\omega = -\left\{\frac{\frac{3m^2\alpha}{(1 - e^{-m\alpha t})} + \frac{3m^2(2-\alpha)}{(1 - e^{-m\alpha t})^2} - \frac{m\alpha\lambda}{2}\frac{e^{-m(4-\alpha)t}}{(1 - e^{-m\alpha t})^{\frac{4}{\alpha}}} + \frac{3\lambda^2}{8}\frac{e^{-2m(4-\alpha)t}}{(1 - e^{-m\alpha t})^{\frac{8}{\alpha}}}}{6m^2(1 - e^{-m\alpha t})^{-2} - \frac{3\lambda^2}{8} e^{-2m(4-\alpha)t}(1 - e^{-m\alpha t})^{\frac{-8}{\alpha}}}\right\}. \tag{27}$$

5. Discussion and conclusion:

The spatial volume is finite at $t = 0$. It expands exponentially as t increases and becomes infinitely large as $t \to \infty$. The directional Hubble parameters are infinite at $t = 0$ and finite at $t = \infty$. It is observed that this space-time expands anisotropically since the shear scalar $\sigma^2 \to \frac{3\lambda^2}{8}$ (non-zero) as time $t \to 0$ and become isotropic as time increases.

The dynamics of energy density (ρ) for Kaluza-Klein space-time is as shown in figure (ii). The energy density of the DE component $\rho \to \infty$ as $t \to 0$ and as $t \to \infty$, the energy density $\rho \to 3m^2 > 0$. Here we observe that the model start with big bang having infinite density and as time increase (for finite time) the energy density ρ tends to finite value. Hence after some finite time the models approaches to steady state. In figure (iii) we plot anisotropy parameter of expansion Δ against cosmic time t. It is observed that in this model anisotropy increases as time increases and then decreases to zero after some time and remains zero after some finite time. Hence, the model reaches to isotropy after some finite time which matches with the recent observation as the universe is isotropic at large scale. The evolution of expansion scalar θ for $\alpha = 1$ is as shown in figure (iv). It is observed that the expansion is infinite at $t = 0$ but as cosmic time t increases it decreases and remains constant throughout the evolution of the universe ($\theta = 4m$). Also at rest when $t \to 0$, the EoS parameter ω tends to infinity and as time increases, the EoS parameter ω tends to -1 which gives the strong support to the existence of dark energy.

The energy density of the fluid ρ, the deviation-free EoS parameter ω and the deviation parameter δ are dynamical. As $t \to \infty$, the anisotropic fluid isotropizes and mimics the vacuum energy which is mathematically equivalent to the cosmological constant (Λ) i.e. $\delta \to 0, \omega \to -1$ and $\rho \to 6m^2 > 0$.

Here the anisotropy of the model isotropizes after finite time t which matches with the observation as the universe is initially (at the time of Big-bang) anisotropic and soon after time it isotropizes.

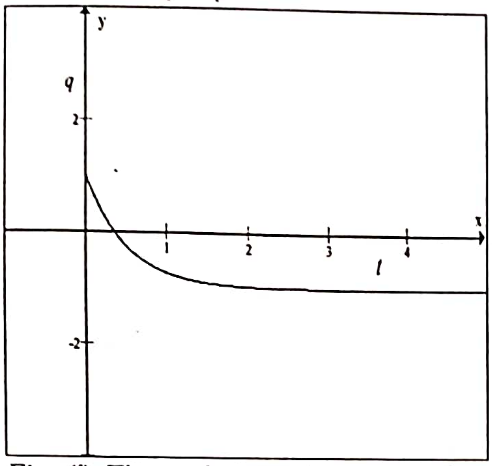

Fig. (i) The variation of q vs. t for $\alpha = 2$.

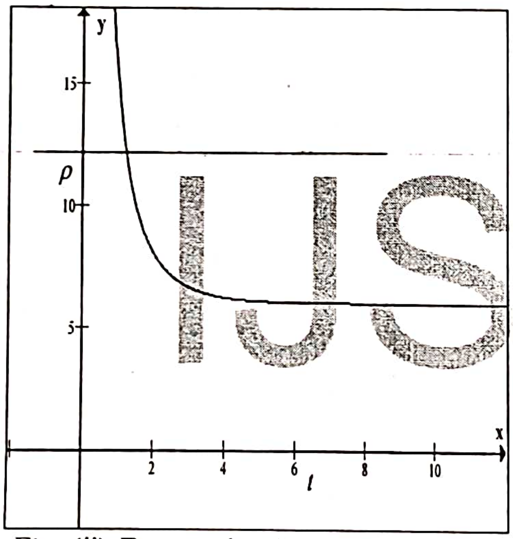

Fig. (ii) Energy density ρ vs. cosmic time t for $\lambda = \alpha = m = 1$.

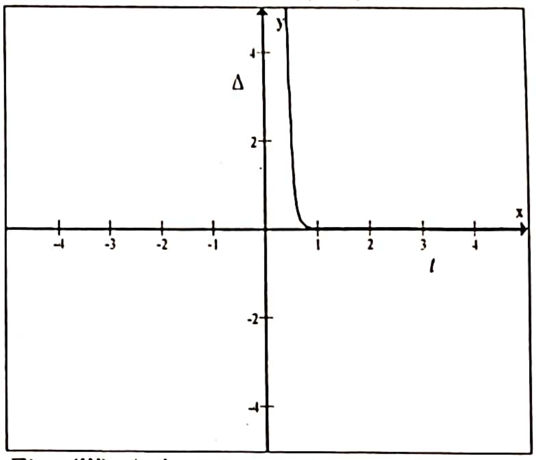

Fig. (iii) Anisotropy parameter Δ vs. cosmic time t for $\lambda = \alpha = m = 1$.

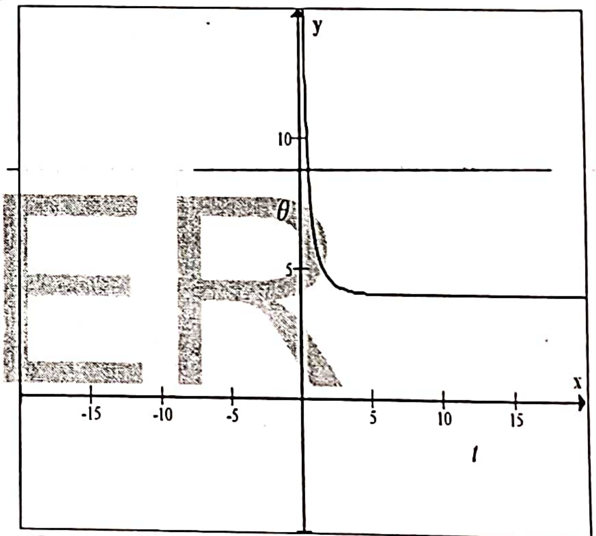

Fig. (iv) Expansion scalar θ vs. cosmic time t *for* $m = \alpha = 1$.

In this paper we have studied Kaluza-Klein cosmological model with anisotropic dark energy and special form of deceleration parameter. The physical and geometrical aspects of the model are also studied and analyze in details. Thus, even if we observe an isotropic expansion in the present universe we still cannot rule out possibility of DE with an anisotropic EoS. We can also conclude that an anisotropic DE does not necessarily distort the symmetry of the space, and consequently even if it turns out that spherical symmetry of the universe that achieved during inflation has not distorted in the later times of the universe, we can not rule out the possibility of an anisotropic nature of the DE at least in Kaluza- Klein framework.

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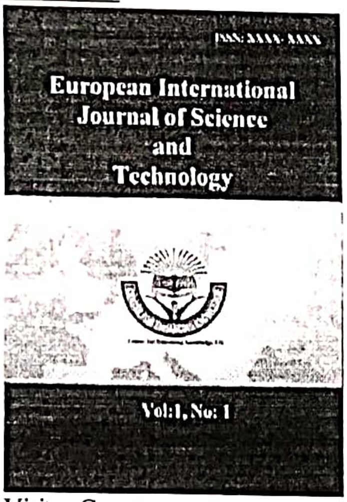

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Bianchi Type – III Dark Energy Cosmological Model in $f(R)$ Theory of Gravitation

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Abstract
In this paper we have used different f(R) action, coupled to two scalar fields in order to obtain a new Bianchi type – III cosmological model in f(R) theory of Gravity. We have derived the standard cosmological quantities and compared them with the respective cosmological quantities in General Relativity.

Keywords: Equation of State, *f*(R)-Gravity, Bianchi Type – III Model, Dynamical Parameters

1. Introduction

In modern cosmology, the concept of cosmic microwave background (CMB) is most important. Its theoretical aspects play an important role. Standard model of cosmology is based on the inflation theory as well as theoretical aspects of cosmic microwave background. These fundamental concepts are expressed in several recent text books. The standard model of cosmology is mathematically treated by the Bianchi type - III model. This model is consistent with the early and current state universe. It has been observed that the universe is homogeneous and isotropic in the large scale structure [7]. We find that some standard cosmological models are based on general relativity, which are unable to explain; like unisotropy or the accelerated expansion of the universe. Therefore, the standard model cosmology should be replaced by other types, based on alternative theories of gravity [9-22]. *f(R)*theory of gravity [1-6] is one of them. In this theory the common Einstein-Hilbert action

$$S_{E-H} = \frac{1}{16\pi G}\int d^4x\sqrt{-g}\left(R-2\Lambda\right)+\int d^4x\sqrt{-g}\,L_m \tag{1.1}$$

is replaced by

$$S_{f(R)} = \frac{1}{16\pi G}\int d^4x\sqrt{-g}\left(f(R)-2\Lambda\right)+\int d^4x\sqrt{-g}\,L_m \tag{1.2}$$

Where $f(R)$ is a function of space-time Ricci scalar curvature R and L_m is the matter Lagrangian. Now, by varying the action (1.2) with respect to the space-time metric $g_{\mu\nu}$, we get the corresponding field equations as

$$f'(R)R_{\mu\nu}-\frac{1}{2}f(R)g_{\mu\nu}-\nabla_{\mu}\nabla_{\nu}f'(R)+g_{\mu\nu}\Box f'(R)+g_{\mu\nu}\Lambda=8\pi GT_{\mu\nu} \tag{1.3}$$

where $f'(R)=\frac{df(R)}{dR}$, $\Box\equiv\nabla^{\mu}\nabla_{\mu}$, ∇_{μ} is the covariant derivative, $T_{\mu\nu}$ is the standard matter energy-momentum tensor derived from the Lagrangian L_m. These are the fourth order partial differential equations in the metric tensor $g_{\mu\nu}$.

2. Bianchi type –III cosmological Model Coupled to Scalar Fields in Standard Cosmology

We introduce the following relation as a substitution for relation (1.2)

$$S=\frac{1}{16\pi G}\int d^4x\sqrt{-g}\left[G(\varphi)R+F(\psi)-2\Lambda\right]+\int d^4x\sqrt{-g}L_m \tag{2.1}$$

Here $\varphi\equiv\varphi(R)$ and $\psi\equiv\psi(R)$ the consequent field equations would be

$$\begin{aligned}&\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]R_{\mu\nu}-\frac{1}{2}g_{\mu\nu}\left[RG(\varphi)+F(\psi)-2\Lambda\right]\\&-\nabla_{\mu}\nabla_{\nu}\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]\\&+g_{\mu\nu}\Box\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]=8\pi GT_{\mu\nu}\end{aligned} \tag{2.2}$$

where the prime stands for differentiation with respect to R.

The dynamics of standard cosmology come from the Bianchi type– III model and its geometric interpretations of space-time, using the line element

$$ds^2=dt^2-A^2dx^2-B^2e^{-2ax}dy^2-C^2dz^2 \tag{2.3}$$

in which A,B and C are the functions of the cosmic time t only and 'a' is non-zero constant.

According to this model, we have a homogeneous isotropic distribution of matter, forming the energy-momentum tensor of the perfect fluid.

$$T_{\mu\nu}=(\rho+p)U\otimes U+g_{\mu\nu}p \tag{2.4}$$

here, ρ is the energy density and p is the pressure of the cosmic fluid. Also U_{μ} is the 4-velocity vector.

According to the field equations, we can derive

$$\begin{aligned}8\pi GT_{00}&=8\pi G\rho=\left[G(\varphi)+RG'(\varphi)F'(\psi)\right]R_{00}-\frac{1}{2}g_{00}\left[RG(\varphi)+F(\psi)-2\Lambda\right]\\&-\partial_0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]\\&+g_{00}\left\{g^{00}\partial_0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]-\left(\Gamma^0_{11}+\Gamma^0_{22}+\Gamma^0_{33}\right)\partial_0\left[RG(\varphi)+F(\psi)-2\Lambda\right]\right\}\end{aligned} \tag{2.5a}$$

and

$$8\pi G T_{11} = 8\pi G p = [G(\varphi) + RG'(\varphi) + F'(\psi)]R_{11} - \frac{1}{2} g_{11}[RG(\varphi) + F(\psi) - 2\Lambda]$$
$$-\Gamma_{11}^{0}\partial_0[G(\varphi) + RG'(\varphi) + F'(\psi)]$$
$$+ g_{11}\{g^{00}\partial_0\partial_0[G(\varphi) + RG'(\varphi) + F'(\psi)] - (\Gamma_{11}^{0} + \Gamma_{22}^{0} + \Gamma_{33}^{0})\partial_0[RG(\varphi) + F(\psi) - 2\Lambda]\}$$

(2.5b)

Using equation (2.3) in (2.5), we get

$$8\pi G\rho = \left[G + R\frac{dG}{d\varphi}\frac{d\varphi}{dR} + \frac{dF}{d\psi}\frac{d\psi}{dR}\right]R_{00} - \frac{1}{2}[RG + F - 2\Lambda]$$
$$+ (\Gamma_{11}^{0} + \Gamma_{22}^{0} + \Gamma_{33}^{0})\left\{2\frac{dG}{d\varphi}\varphi'\dot{R} + R\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi' + \frac{dG}{d\varphi}\dot{\varphi}'\right] + \left(\frac{dF}{d\psi}\right)^{\cdot}\psi' + \frac{dF}{d\psi}\dot{\psi}'\right\} \quad (2.6a)$$

$$8\pi G p = \left[G + R\frac{dG}{d\varphi}\frac{d\varphi}{dR} + \frac{dF}{d\psi}\frac{d\psi}{dR}\right]R_{11} + \frac{1}{2}A^2[RG + F - 2\Lambda]$$
$$+ (-2A^2)\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'\dot{R} + \frac{dG}{d\varphi}\dot{\varphi}'\dot{R} + \frac{dG}{d\varphi}\ddot{R}\right] - A^2\left\{\dot{R}\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi' + \frac{dG}{d\varphi}\dot{\varphi}'\right] + R\left[\left(\frac{dG}{d\varphi}\right)^{\cdot\cdot}\varphi' + 2\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi' + \frac{dG}{d\varphi}\ddot{\varphi}'\right]\right\}$$
$$- A^2\left[\left(\frac{dF}{d\psi}\right)^{\cdot\cdot} + 2\left(\frac{dF}{d\psi}\right)^{\cdot}\dot{\psi}' + \frac{dF}{d\psi}\ddot{\psi}'\right] + A^2(\Gamma_{11}^{0} + \Gamma_{22}^{0} + \Gamma_{33}^{0})\left[2\frac{dG}{d\varphi}\varphi'\dot{R} + R\left(\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi' + \frac{dG}{d\varphi}\dot{\varphi}'\right) + \left(\frac{dF}{d\psi}\right)^{\cdot}\psi' + \frac{dF}{d\psi}\dot{\psi}'\right]$$

(2.6b)

The dot stands for differentiation with respect to cosmic time t. These values will be derived explicitly, when we consider

$$R_{00} = \frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\ddot{C}}{C}$$
$$R_{11} = -\left(A\ddot{A} + \frac{A\dot{A}\dot{B}}{B} + \frac{A\dot{A}\dot{C}}{C}\right) + a^2 \quad (2.7)$$
$$R = 2\left(\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\ddot{C}}{C} + \frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{C}\dot{A}}{CA} - \frac{a^2}{A^2}\right)$$

And

$\Gamma_{11}^{0} = A\dot{A}$

$\Gamma_{22}^{0} = B\dot{B}e^{-2ax}$

$\Gamma_{33}^{0} = C\dot{C}$

3. Dynamical Properties for Definite Scalar Potentials in Bianchi Type-III

Now let us consider

$G(\varphi) \equiv G(R) \doteq R$

$$F(\psi) \equiv F\left(\frac{1}{R}\right) \doteq \frac{1}{R} \tag{3.1}$$

Using equation (3.1) in equation (2.6), while considering the values in equation (2.7), we obtain

$$8\pi G\rho = \left[4(\alpha) - \frac{1}{4}(\alpha)^{-2}\right]\left(\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\ddot{C}}{C}\right) - 2(\alpha)^2 - \frac{1}{4}(\alpha)^{-1} + \Lambda$$
$$-\left(A\dot{A} + B\dot{B}e^{-2ax} + C\dot{C}\right)\left[4(\beta) + \frac{1}{2}(\alpha)^{-3}(\beta)\right] \tag{3.2a}$$

and

$$8\pi Gp = \left[4(\alpha) - \frac{1}{4}(\alpha)^{-2}\right]\left(-A\ddot{A} - \frac{A\dot{A}\dot{B}}{B} - \frac{A\dot{A}\dot{C}}{C} + a^2\right) + A^2\left[2(\alpha)^2 + \frac{1}{4}(\alpha)^{-1} + \Lambda\right]$$
$$+A^2\left\{2(\beta) + \frac{1}{2}(\alpha)^{-3}(\beta) - 4(\gamma) + \frac{3}{2}(\alpha)^{-4}(\beta)^2 - \frac{1}{2}(\alpha)^{-3}(\gamma) + \left(A\dot{A} + B\dot{B}e^{-2ax} + C\dot{C}\right)\left[4(\beta) + \frac{1}{2}(\alpha)^{-3}(\beta)\right]\right\} \tag{3.2b}$$

Where,

$$\alpha = \left[\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\ddot{C}}{C} + \frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{C}\dot{A}}{CA} - \frac{a^2}{A^2}\right] \tag{3.3}$$

$$\beta = \frac{A^{(3)}}{A} - \frac{\dot{A}\ddot{A}}{A^2} + \frac{B^{(3)}}{B} - \frac{\dot{B}\ddot{B}}{B^2} + \frac{C^{(3)}}{C} - \frac{\dot{C}\ddot{C}}{C^2} + \left(\frac{\dot{A}\ddot{B}}{AB} + \frac{\ddot{A}\dot{B}}{AB} - \frac{\dot{A}\dot{B}^2}{AB^2} - \frac{\dot{A}^2\dot{B}}{A^2B}\right) + \left(\frac{\dot{B}\ddot{C}}{BC} + \frac{\ddot{B}\dot{C}}{BC} - \frac{\dot{B}\dot{C}^2}{BC^2} - \frac{\dot{B}^2\dot{C}}{B^2C}\right)$$
$$+\left(\frac{\dot{C}\ddot{A}}{CA} + \frac{\ddot{C}\dot{A}}{CA} - \frac{\dot{C}\dot{A}^2}{CA^2} - \frac{\dot{C}^2\dot{A}}{C^2A}\right) + 2a^2\frac{\dot{A}}{A^3} \tag{3.4}$$

and

$$\gamma = \frac{A^{(4)}}{A} - 2\frac{A^{(3)}\dot{A}}{A^2} - \frac{\ddot{A}^2}{A^2} + 2\frac{\dot{A}^2\ddot{A}}{A^3} + \frac{B^{(4)}}{B} - 2\frac{B^{(3)}\dot{B}}{B^2} - \frac{\ddot{B}^2}{B^2} + 2\frac{\dot{B}^2\ddot{B}}{B^3} + \frac{C^{(4)}}{C} - 2\frac{C^{(3)}\dot{C}}{C^2} - \frac{\ddot{C}^2}{C^2} + 2\frac{\dot{C}^2\ddot{C}}{C^3}$$
$$+\left(\frac{\dot{A}B^{(3)}}{AB} + \frac{\ddot{A}\ddot{B}}{AB} - \frac{\dot{A}\dot{B}\ddot{B}}{AB^2} - \frac{\dot{A}^2\ddot{B}}{A^2B}\right) + \left(\frac{\ddot{A}\ddot{B}}{AB} + \frac{A^{(3)}\dot{B}}{AB} - \frac{\ddot{A}\dot{B}^2}{AB^2} - \frac{\dot{A}\ddot{A}\dot{B}}{A^2B}\right) - \left(2\frac{\dot{A}\dot{B}\ddot{B}}{AB^2} + \frac{\ddot{A}\dot{B}^2}{AB^2} - 2\frac{\dot{A}\dot{B}^3}{AB^3} - \frac{\dot{A}^2\dot{B}^2}{A^2B^2}\right)$$
$$-\left(\frac{\dot{A}^2\ddot{B}}{A^2B} + 2\frac{\dot{A}\ddot{A}\dot{B}}{A^2B} - \frac{\dot{A}^2\dot{B}^2}{A^2B^2} - 2\frac{\dot{A}^3\dot{B}}{A^3B}\right) + \left(\frac{\dot{B}C^{(3)}}{BC} + \frac{\ddot{B}\ddot{C}}{BC} - \frac{\dot{B}\dot{C}\ddot{C}}{BC^2} - \frac{\dot{B}^2\ddot{C}}{B^2C}\right) + \left(\frac{\ddot{B}\ddot{C}}{BC} + \frac{B^{(3)}\dot{C}}{BC} - \frac{\ddot{B}\dot{C}^2}{BC^2} - \frac{\dot{B}\ddot{B}\dot{C}}{B^2C}\right)$$
$$-\left(2\frac{\dot{B}\dot{C}\ddot{C}}{BC^2} + \frac{\ddot{B}\dot{C}^2}{BC^2} - 2\frac{\dot{B}\dot{C}^3}{BC^3} - \frac{\dot{B}^2\dot{C}^2}{B^2C^2}\right) - \left(\frac{\dot{B}^2\ddot{C}}{B^2C} + 2\frac{\dot{B}\ddot{B}\dot{C}}{B^2C} - \frac{\dot{B}^2\dot{C}^2}{B^2C^2} - 2\frac{\dot{B}^3\dot{C}}{B^3C}\right)$$
$$+\left(\frac{\dot{C}A^{(3)}}{CA} + \frac{\ddot{C}\ddot{A}}{CA} - \frac{\dot{C}\dot{A}\ddot{A}}{CA^2} - \frac{\dot{C}^2\ddot{A}}{C^2A}\right) + \left(\frac{\ddot{C}\ddot{A}}{CA} + \frac{C^{(3)}\dot{A}}{CA} - \frac{\ddot{C}\dot{A}^2}{CA^2} - \frac{\dot{C}\ddot{C}\dot{A}}{C^2A}\right) - \left(2\frac{\dot{C}\dot{A}\ddot{A}}{CA^2} + \frac{\ddot{C}\dot{A}^2}{CA^2} - 2\frac{\dot{C}\dot{A}^3}{CA^3} - \frac{\dot{C}^2\dot{A}^2}{C^2A^2}\right)$$
$$-\left(\frac{\dot{C}^2\ddot{A}}{C^2A} + 2\frac{\dot{C}\ddot{C}\dot{A}}{C^2A} - \frac{\dot{C}^2\dot{A}^2}{C^2A^2} - 2\frac{\dot{C}^3\dot{A}}{C^3A}\right) + 2a^2\left(\frac{\ddot{A}}{A^3} - 3\frac{\dot{A}^2}{A^4}\right) \tag{3.5}$$

4. The Model to Determine EoS

According to general relativity, the energy deposit of universe could be derived from

$$R^i_j - \frac{1}{2}R\delta^i_j + \Lambda = 8\pi G T^i_j \qquad (4.1)$$

For which the Bianchi-III model implies that

$$\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{C}\dot{A}}{CA} - \frac{a^2}{A^2} = -\rho \qquad (4.2)$$

Also the same procedure for the fluid pressure p, results in

$$\frac{\ddot{B}}{B} + \frac{\ddot{C}}{C} + \frac{\dot{B}\dot{C}}{BC} = p \qquad (4.3)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{C}}{C} + \frac{\dot{A}\dot{C}}{AC} = p \qquad (4.4)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} - \frac{a^2}{A^2} = p \qquad (4.5)$$

And

$$\frac{\dot{A}}{A} - \frac{\dot{B}}{B} = 0 \qquad (4.6)$$

When$8\pi G = 1$ $and\Lambda = 0$.

Above equation (4.6) implies

$$A = B \qquad (4.7)$$

Using above equation the field equations (4.2) to (4.5) implies

$$\frac{\ddot{A}}{A} + \frac{\ddot{C}}{C} + \frac{\dot{A}\dot{C}}{AC} = p \qquad (4.8)$$

$$2\frac{\ddot{A}}{A} + \left(\frac{\dot{A}}{A}\right)^2 - \frac{a^2}{A^2} = p \qquad (4.9)$$

And

$$\left(\frac{\dot{A}}{A}\right)^2 + 2\frac{\dot{A}\dot{C}}{AC} - \frac{a^2}{A^2} = -\rho \qquad (4.10)$$

The field equations (4.8) to (4.10) are a system of three non-linear differential equations with four unknowns A, C, ρ, p.

Hence in order to solve the system completely we assume physical condition that shear scalar σ is proportional to scalar expansion θ, which gives the following relation between metric function as

$$C = A^n \qquad (4.11)$$

where $n \neq 1, n. > 1$, is an arbitrary constant.

Equating equation (4.8) and equation (4.9), we have

$$\frac{\ddot{A}}{A} - \frac{\ddot{C}}{C} + \left(\frac{\dot{A}}{A}\right)^2 - \frac{\dot{A}\dot{C}}{AC} - \frac{a^2}{A^2} = 0 \qquad (4.12)$$

Using equation (4.11) in equation (4.12), we get

$$A\ddot{A} + (1+n)\dot{A}^2 = \frac{a^2}{(1-n)} \qquad (4.13)$$

Let us consider

$\dot{A} = g(A)$,

$$\ddot{A} = gg^{\bullet} \text{ where } g^{\bullet} = \frac{dg}{dA} \tag{4.14}$$

With the help of equation (4.14), equation (4.13) reduces to

$$2gg^{\bullet} + 2(n+1)\frac{g^2}{A} = 2\frac{a^2}{(1-n)A} \tag{4.15}$$

Solving equation (4.15) and on integration, we get

$$A^{(2n+2)}g^2 = 2\frac{a^2}{(1-n)}\frac{A^{(2n+2)}}{(2n+2)} + k_1 \tag{4.16}$$

Where k_1 is the constant of integration.

$$\text{But } g = \dot{A} \text{ and } g^2 = \dot{A}^2 \tag{4.17}$$

Using equation (4.17) inequation (4.16), we get

$$\frac{A^{(1+n)}dA}{\sqrt{\frac{a^2}{(1-n^2)}A^{(2n+2)} + k_1}} = dt \tag{4.18}$$

To get determinate solution, we take $k_1 = 0$

$$\left[\frac{a^2}{(1-n^2)}\right]^{-\frac{1}{2}} dA = dt \tag{4.19}$$

On integration,

$$A = (t + k_2)\left[\frac{a^2}{(1-n^2)}\right]^{\frac{1}{2}} \tag{4.20}$$

Where k_2 is the constant of integration.

Using equation (4.7) and equation (4.11), we obtain the scale factors A, B *and* C as

$$A = k_3(t + k_2) \tag{4.21}$$

$$B = k_3(t + k_2) \tag{4.22}$$

And

$$C = k_4(t + k_2)^n \tag{4.23}$$

Where,

$$k_3 = \left[\frac{a^2}{(1-n^2)}\right]^{\frac{1}{2}} \text{ and } k_4 = k_3^{\,n}$$

Using equations (4.21) and (4.23) in equation (4.10), we obtain the energy density (ρ) as

$$\rho = k_5(t + k_2)^{-2} \tag{4.24}$$

Using equations (4.21) and (4.23) in equation (4.9), we obtain the pressure (p) as

$$p = k_6(t + k_2)^{-2} \tag{4.25}$$

From equation (4.24) and equation (4.25), we can write

$$\rho = p \tag{4.26}$$

Also we know that the EoS could be derived from

$$\omega = \frac{p}{\rho} \tag{4.27}$$

Which implies $\omega = constant$ (4.28)

5. Calibrating the energy density and the fluid pressure using *f(R)* equations

Using equation (4.7), equation (4.21) and equation (4.23) in equations (3.3), (3.4) and (3.5) we get

$$\alpha = N_1 (t + k_2)^{-2} \tag{5.1}$$

$$\beta = N_2 (t + k_2)^{-3} \tag{5.2}$$

$$\gamma = N_3 (t + k_2)^{-4} \tag{5.3}$$

Where $N_1, N_2 and N_3$ are constant terms.

Using equations (5.1), (5.2) and (5.3) in equations (3.2a),(3.2b) while considering $8\pi G = 1$ and $\Lambda = 0$, we obtain energy density and fluid pressure in terms of *f(R)* gravity

$$\rho = \frac{4n(n-1)N_1}{(t+k_2)^4} - \frac{n(n-1)}{4N_1^2 (t+k_2)^2} - \frac{2N_1^2}{(t+k_2)^4} - \frac{1}{4N_1 (t+k_2)} - \left[k_3^2 (t+k_2)(1+e^{-2ax}) + k_4^2 n (t+k_2)^{2n-1}\right] \left[\frac{4N_2}{(t+k_2)^3} + \frac{N_2}{2N_1^3 (t+k_2)^2}\right] \tag{5.4}$$

$$p = \frac{-4k_3^2(n+1)}{(t+k_2)^2} + \frac{4a^2 N_1}{(t+k_2)^2} + \frac{k_3^2 (n+1)}{4N_1^2} - \frac{a^2}{4N_1^2} + \frac{2k_3^2 N_1^2}{(t+k_2)^2} + \frac{k_3^2 (t+k_2)}{4N_1} + \frac{2k_3^2 N_2}{(t+k_2)} + \frac{k_3^2 N_2}{2N_1^3} - \frac{4k_3^2 N_3}{(t+k_2)^2} + \frac{3k_3^2 N_2^2}{2N_1^4 (t+k_2)^2} - \frac{k_3^2 N_3}{2N_1^3 (t+k_2)} + \left[k_3^2 (t+k_2)(1+e^{-2ax}) + k_4^2 n (t+k_2)^{2n-1}\right] \left[\frac{4k_3^2 N_2}{(t+k_2)} + \frac{k_3^2 N_2}{2N_1^3}\right] \tag{5.5}$$

Using equations (5.4) and (5.5), the EoS $\left(\omega = \frac{p}{\rho}\right)$ could be derived in *f*(R) Gravity

It's like

$$\omega = \frac{p}{\rho} = \frac{1}{t^2}\frac{t^4}{1} = t^2 \tag{5.6}$$

6. Physical behavior of the Model

The Hubble parameter H is defined by

$$H = \frac{\dot{V}}{V} \tag{6.1}$$

Where $V^3 = ABCe^{ax}$ and (6.2)

The deceleration parameter q is

$$q = -\frac{V\ddot{V}}{\dot{V}^2} \tag{6.3}$$

The scalar of expansion

$$\theta = 3\frac{\dot{V}}{V} \tag{6.4}$$

And the dynamical parameters are the shear σ defined by

$$\sigma^2 = \frac{1}{12}\left\{\left[\frac{g_{11,0}}{g_{11}} - \frac{g_{22,0}}{g_{22}}\right]^2 + \left[\frac{g_{22,0}}{g_{22}} - \frac{g_{33,0}}{g_{33}}\right]^2 + \left[\frac{g_{33,0}}{g_{33}} - \frac{g_{11,0}}{g_{11}}\right]^2\right\} \tag{6.5}$$

For our model, these parameters are

$$H = \frac{(2+n)}{3(t+k_2)}, \qquad q = \frac{(1-n)}{(2+n)} \tag{6.6}$$

$$\theta = \frac{(2+n)}{(t+k_2)} \text{ and } \sigma^2 = \frac{2(n^2-2n+1)}{3(t+k_2)^2}$$

7. Conclusion:

We have considered Bianchi type –III cosmological model in *f*(R) theory and determined field equations. Some physical properties had been studied. Then we derived the EoS and we observed that in general relativity it remain constant. Having the resultant field equations in the standard cosmological model, we derived the energy density and the fluid pressure in our model, which were specified for definite interpretations of the scalar fields. We observed that, if cosmic time t goes on increasing continuously and after a very long time, energy density ρ and fluid pressure p will vanished.

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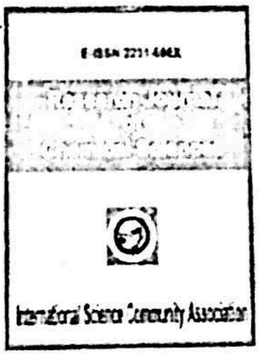

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Current Issue

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Short Communication

Evaluation of New 2-N-tert-butyl-5-aryl-1, 3, 4-Oxadiazol-2-Amines for Antimicrobial Activity

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Abstract

A series of five membered heterocyclic oxadiazole derivatives synthesized by intramolecular cyclisation of N-tert-butyl-2-aroyl hydrazine carbothioamides (IIa-g) with iodine-pot.iodide in basic medium were tested for their biological activities against selected microorganisms. The newly synthesized compounds were investigated for their antimicrobial activities by Agar diffusion method. For antibacterial study, the bacterial strain used included both gram-positive strains like Ecoli and gram negative strain S.aureus. Antifungal activity was performed against the fungus A. niger. Among the synthesized compounds (IIIa-g), few compounds showed weak antimicrobial activities in comparison with standard drugs.

Keywords: 1,3,4-oxadiazoles, Antimicrobial activities, Gentamycin, Amphotericin.

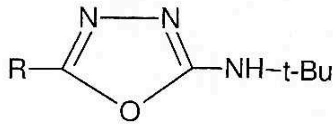
Introduction

Since the past few decades extensive work had been done on the synthesis and pharmacological activities of various heterocyclic compounds specially substituted azole derivatives. Among the five membered heterocyclic rings, oxadiazole is one of the important compounds for designing potential bioactive agents. The oxadiazole derivatives are known to have wide biological activities such as antimicrobial[1-4], anticonvulsant[5-6], analgesic activity[7], antitubercular[8]. The 1,3,4-oxadiazoles is one of the popular bio-active molecule in pharmaceutical and medicinal chemistry. Most of the antimicrobial agents are known with different structures which are generally used in the treatment of fungal infections, activity of these drugs is based on structure antimicrobial relationship. Various different methods have been proposed to synthesize substituted oxadiazoles. The oxidative cyclization of carbothioamides[9-16] is one of the important methods for oxadiazole synthesis. In the present study, we have discussed about evaluation of some 2,5-substituted 1,3,4-oxadiazoles for antimicrobial studies. The synthesized compounds were tested against some selected microorganisms for their antibacterial and antifungal activities.

Materials and Methods

Chemistry: A new series of 2-N-tert-butyl-5-aryl-1,3,4-oxadiazol-2-amines (IIIa-g) were generated by oxidative cyclization of different N-tert-butyl-2-aroylhydrazine carbothioamide (IIa-g) according to the known procedure. The structure and purity of the compounds synthesized was confirmed by C,H,N analysis,: IR, ^{1}H NMR spectral methods and TLC.

Biological Activities: A new series of different 2,5--substituted oxadiazoles were subjected to antimicrobial screening have the following general formula.



Scheme-1
2-N-tert-butyl-5-aryl-1,3,4-oxadiazol-2-amines (IIIa-g)

Where: R, a = p-$NO_2C_6H_4$_, b = -$CH_2C_6H_5$, c = -C_6H_5, d = O-OHC_6H_4-, e = O-ClC_6H_4-, f = P-ClC_6H_4-, g = -C_4H_5N

The microbiological assay was done by comparing the inhibition growth of microorganisms with measured concentrations of test compounds with the known concentration of a standard drug. The antimicrobial activity of a compound is generally expressed as its inhibiting effect toward the growth of the bacterium in nutrient broth or nutrient agar. The present antimicrobial study used the agar diffusion method[17-19] to deals with the study of synthesized compounds for antifungal and antibacterial activity.

Biological Activity: Using agar diffusion method the antibacterial activities of the compounds were tested. The bacterial strain used included both *Staphylococcus aureus* and *Escherichia coli.*

The medium used for the study of antibacterial activity of newly synthesized compounds having the following composition.

Media Used (Nutrient broth): NaCl-10g, Peptone-10 g and Yeast extract 5g, Agar 20g in 1000 ml of distilled water. The two bacterial organism were used for testing the antibacterial activities of the compounds namely *Staphylococcus aureus* and E. *coli* bacteria using concentration 20 mg/mL by agar diffusion method. The antibiotic Gentamycin was used to compare the activities of compounds. All the compounds were diluted in Dimethyl sulfoxide with the concentration of 20 mg/ml. Nutrient broth of above composition was used as a growth media. The stock solution was serially diluted to give concentrations of 0.0625, 0.125, 0.25, 0.5, 1.0 and 2.0 mg in nutrient broth. The incubation periods for all the plates were 24 h at 37^0C for and inhibition zones diameter were noted.

The antifungal activity was performed using the similar method. The fungus used was - *Aspergillus niger.* The medium used for the study of antifungal activity of these newly synthesized compounds having following composition, was of fungistatic grade. It was found to be suitable for the growth of fungus, *Aspergillus niger* used in the present study.

Czapek-Dox agar medium was made ready with 56.01 g of ingredients and 1 liter of distilled water. Initially, the inoculum in broth media of stock cultures was done and grown at 27^0C for 48 hrs.

Dimethyl sulfoxide was used to dissolve the test compounds and to give 10 mg/ml of concentration. The agar plates were made ready with agar and developed the wells. Each plate was inoculated of plates was done for 48 h old cultures (100 µl 10^4 CFU). The different dilution 0.0625, 0.125, 0.25, 0.5, 1.0 and 2.0 mg of samples was done to prepare the well. The antibiotic was used to fill the control wells. The standard drug Amphotericin was used. The incubation of plates was done at 27^0C for 72 h and the observations were made for the diameters of inhibition zone.

Results and Discussion

The growth of various bacterial and fungal organisms on test compounds for testing their antimicrobial activities is summarized in Table-1. The screening results of the newly synthesized compounds (IIIa-g) revealed that the compounds (IIIc), (IIId) and (IIIg) showed moderate bactericidal activity while other was totally inactive. Compound (IIIe) and (IIIf) were found to be weakly fungicidal against the organism *A. niger* while the other compounds were not active.

Conclusion

In conclusion, in present we investigated the antimicrobial activities of some newly synthesized oxadiazole derivatives says 2-N-tert-butyl-5-aryl-1,3,4-oxadiazol-2-amine (IIIa-g). The bacterial strain *S. aureus* and *E. coli* were used to test the antimicrobial activities of the compounds. For comparison Gentamycin was used. The antifungal activity was performed against *Aspergillus niger.* Amphotericin used as standard. Compounds were least active against tested microorganism. However, it was found that the tested compounds are much less reactive when compared with the standard drugs used.

Acknowledgement

The authors are grateful to the Principal, Shri Mungsaji Maharaj Mahavidyalaya, Darwha for constant encouragement. Thanks are also due to The Director, Biogenics, Research and Training Centre in Biotechnology Hubli, Karnataka for antimicrobial report.

Table-1
Antimicrobial activity of 2-N-tert-butylamino-5-aryl-1,3,4-oxadiazole(IIIa-g)

Organism	Conc.	IIIa	IIIb	IIIc	IIId	IIIe	IIIf	IIIg
E. Coli	1.0 mg	0	0	6	7	4	4	5
	2.0 mg	3	5	12	13	7	6	8
	MIC mg	2	2	0.5	0.5	1	1	0.5
S.aureus	1.0 mg	2	2	7	10	0	0	0
	2.0 mg	7	6	12	13	2	2	0
	MIC mg	1	1	0.5	0.5	2	2	NF
A. niger	1.0 mg	5	0	0	3	9	7	0
	2.0 mg	9	6	3	6	13	12	2
	MIC mg	1	1	2	1	0.5	0.5	2

Note: NF- MIC not found among the concentrations screened.

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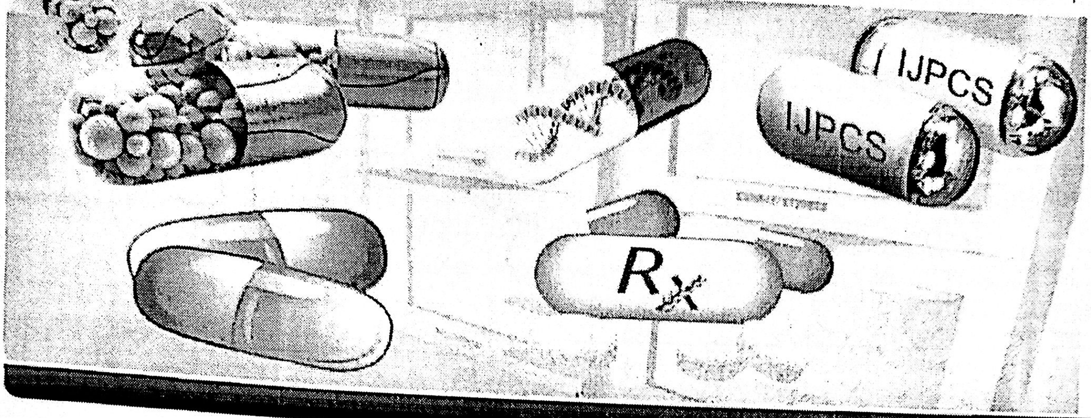

ABSTRACTED AND INDEXED

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Archives

Volume 5, Issue 4, October-December, 2016

Research Article

Synthesis and De-Tert-Butylation of 2-Arylimino-5-Tert-Butylimino-1,3,4-Thiadiazolidines

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ABSTRACT

New 2-arylimino-5-tert-butylimino-1,3,4-thiadiazolidines (IV) were synthesized by cyclization of N-tert-butyl-N'-arylhydrazine-1,2-dicarbothioamides (III). The key intermediate compounds (III) were obtained by the drop wise addition of hydrazine hydrate to aryl isothiocyanate (I) followed by condensation with tert-butyl isothiocyanate in 1:1 ratio in chloroform medium. All the synthesized compounds (IV) were successfully de-tert-butylated into respective 2-arylimino-5-imino-1,3,4-thiadiazolidines (V). All new compounds were characterized by ^{1}H-NMR, IR spectroscopy and elemental analysis.

Keywords: 1,2-dicarbothioamides, cyclization reaction, 1,3,4-thiadiazolidine, de-tert-butylation.

INTRODUCTION

1,3,4-thiadiazoles and derivatives have been widely studied for analytical and industrial interest[1-4]. Different approaches have been reported for the preparation of 1,3,4-thiadiazoles and it's derivative. The acid catalyzed cyclisation of hydrazine carbothioamide is an excellent strategy for the synthesis of 1,3,4-thiadiazoles[5-7]. Here we reported the synthesis of some new substituted 1,3,4-thiadiazolidines (IV) through the intramolecular cyclisation of N-tert-butyl-N'-arylhydrazine-1,2-dicarbothioamides using Iodine-pot.iodine in basic medium.

EXPERIMENTAL

All melting points were uncorrected. IR spectra were measured using KBr disc plate technique on a Bruker FT-IR spectrophotometer. ^{1}HNMR spectra (DMSO-d_6 and $CDCl_3$) were carried out on a Bruker Advance 400 MHz spectrometer using TMS as internal reference (chemical shifts in ó, ppm).

The reagent required for the synthesis of 1,3,4-thiadiazolidines are aryl isothiocyanates[8], *t*-butyl isothiocyanate[9] and N-aryl thiosemicarbazide[10-11] were prepared by already known procedure. The N-tert-butyl-N'-arylhydrazine-1,2-dicarbothioamides (IIIa-f) were prepared by the reaction of N-aryl thiosemicarbazide and *t*-butyl isothiocyanate in chloroform medium as below

Preparation of N-tert-butyl-N'-(p-tolyl) hydrazine-1,2-dicarbothioamide (IIIa)

The p-tolyl thiosemicarbazide (IIa) (0.01 mole) was refluxed with tert-butyl isothiocyanate (0.01 mole) in chloroform medium for 1.5 h. After completion of reaction, the solvent was distilled off. The solid product obtained was crystallized from ethanol, m.p 116^{0}C. The compound was insoluble in water but soluble in organic solvents and was found to be desulphurizable when boiled with alkaline lead acetate solution indicating the presence of >C=S group.

(IIIa): IR spectra[12-14]
(KBr) cm-1: 3272,3219 (N-H), 2955-2849 (C-H), 1310 (C-N), 1178 (C=S); **1H-NMR** (DMSOd^6) ppm: 1.3 (9H, s, t-Bu), 2.2 (3H, s, Ar-CH3), 3.3 (1H, s, t-Bu-NH), 4.5 (1H, s, Ph-NH), 7.0-7.6 (4H, m, Ar-H), 8.7(1H, s, N-H) 9.4 (1H, s, N-H).

On the basis of chemical properties and spectral data, the compound (IIIa) has been assigned the structure as N-tert-butyl-N'-(p-tolyl) hydrazine-1,2-dicarbothioamide.

The other 1,2-dicarbothioamide(IIIb-f) were prepared by extending the above reaction to different thiosemicarbazide (IIb-f), and the related products were isolated in good yield. (Table -1).

Preparation of 2-(p-tolylimino)-5-tert-butylimino-1,3,4-thiadiazolidine (IVa)

Paste of N-tert-butyl-N'-(p-tolyl) hydrazine-1,2-dicarbothioamide (IIIa) (2 gm) was prepared in ethanol. It was basified with 6N NaOH (0.5 ml).To this mixture a solution of iodine containing 1% potassium iodide was added drop wise under cooled condition (5-7 °C) till the colour of iodine persisted. The reaction mixture was kept overnight at room temperature. The solid mass separated was washed thoroughly with water, dried and crystallized from ethanol to yield 75% of 2-(p-tolylimino)-5-tert-butylimino-1,3,4-thiadiazolidine (IVa), m.p 102 ^{0}C.

(**IVa**) : **IR spectra**[12-14]

(KBr) cm-1: 3393 (N-H), 1514(C=N), 1301 (C-N), 811 (C-S) (Plate 6.1);

1H-NMR (DMSOd^6) ppm: 1.3 (9H, s, t-Bu), 2.2 (3H, s, Ar-CH3), 6.4 (1H, s, N-H), 7.01-7.06 (2H, d, Ar-H) 7.0-7.6 (2H, d, Ar-H), 7.9 (1H, d, N-H). (Plate 6.2);

On extending the above reaction to other (IIIb-f), related products (IVb-f) were isolated in good yield. (Table -1)

Preparation of 2-(p-tolylimino)-5-imino-1,3,4-thiadiazolidine (Va)

The 2-p-tolylimino-5-t-butylimino-1,3,4-thiadiazolidine (IVa) (0.01 mole) was boiled with 30% sulphuric acid (10 ml) under reflux for 3 hr. The solid gradually went into solution and a clear solution was obtained. After completion of reaction, the reaction mixture was cooled and poured in ice crushed water. The product (Va) separated was collected, dried and crystallized from ethanol to yield 70%, m.p.121°C.

1H-NMR (DMSOd^6) ppm

2.2 (3H, s, Ar-CH3), 7.01-7.06 (2H, dd, N-H), 7.28-7.30 (2H, d, Ar-H), 7.41-7.42 (2H, d, Ar-H), 8.6(1H, s, N-H). (Plate 6.3);

The absence of signal at 1.3 δppm due to proton of t-Butyl group proved that compound (IVa) has been successfully de-t-butylated[15] into compound (Va). Thus, from spectral data compound (Va) has been assigned the structure of 2-p-tolylimino-5-imino-1,3,4-thiadiazolidine . On extending the above reaction to other (IVb-f), related products (Vb-f) were isolated in good yield. (Table -1)

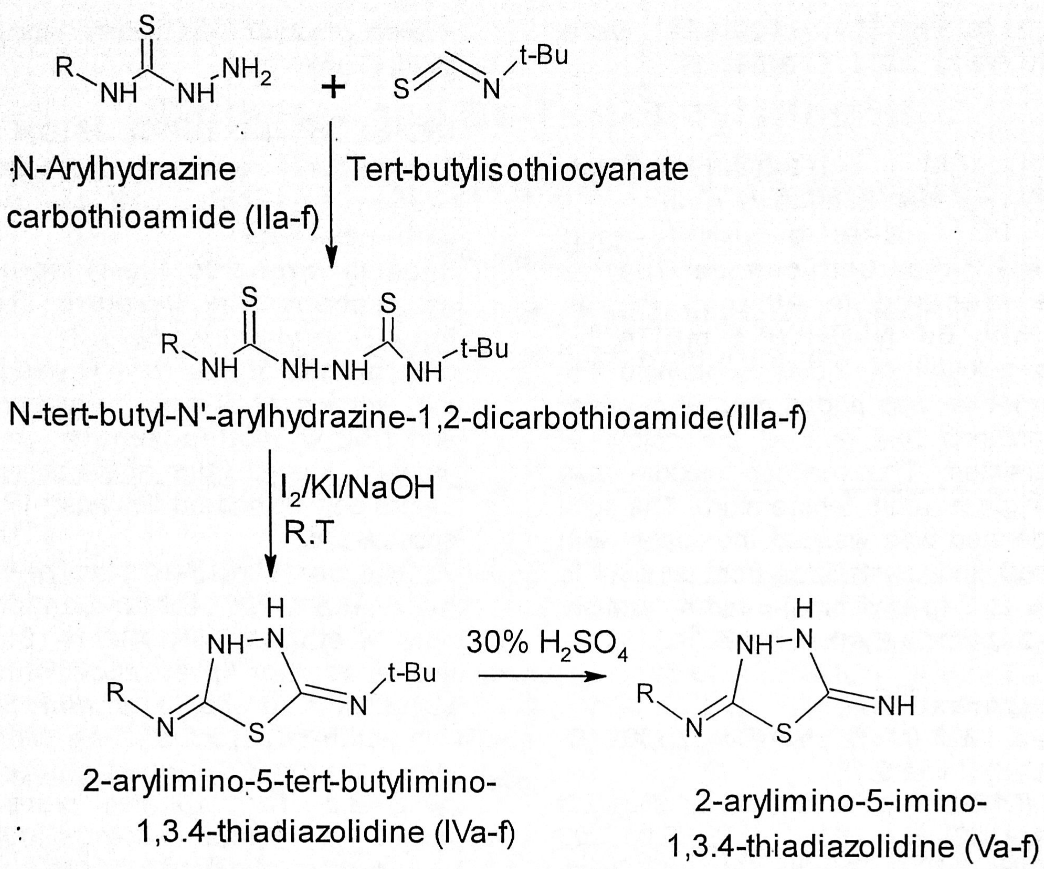
RESULTS AND DISCUSSION

The synthetic route is outlined in *fig:1*. The reagent aryl isothiocyanate(Ia-f), t-butyl isothiocyanate and N-aryl thiosemicarbazide (IIa-f) were prepared as described in literature. The N-tert-butyl-N'-arylhydrazine-1,2-dicarbothioamides (IIIa-f) was prepared by the reaction of N-aryl thiosemicarbazide and *t*-butyl isothiocyanate in chloroform medium. The structure of the compound (IIIa-f) were established on the basis IR and NMR-spectral data.

To the paste of N-tert-butyl-N'-(p-Tolyl) hydrazine-1,2-dicarbothioamide (IIIa) (2 gm) in ethanol, 6N NaOH (0.5 ml) and iodine solution in ethanol containing 1% potassium iodide was added drop by drop with constant stirring. The addition was continued till violet colour of iodine persisted. The mixtures were left over night at room temperature. The separated solids were crystallized from ethanol to yield 75% of compound (IVa), m.p 102^0.

On elemental and IR and H^1-NMR spectral data product (IVa) was found to be 2-(p-tolylimino)-5-tert-butylimino-1,3,4-thiadiazolidine. The other compounds (IVb-f) were prepared by extending the above reaction to other, N-tert-butyl-N'-arylhydrazine-1,2-dicarbothioamides (IIIb-f) and the related products were isolated in good yield. (Table-1).

The 2-p-Tolylimino-5-t-butylimino-1,3,4-thiadiazolidine (IVa) (0.01 mole) was boiled with 30% sulphuric acid (10 ml) under reflux for 3 hr. The solid gradually went into solution and a clear solution was obtained. After completion of reaction, the reaction mixture was cooled and poured in ice crushed water. The product (Va) separated was collected, dried and crystallized from ethanol, yield 70%, m.p.121°C. The absence of signal at 1.3 δppm due to proton of t-Butyl group proved that compound (IVa) has been successfully de-t-butylated[15] into compound (Va). Thus, on the basis of spectral data IR and 1H NMR, the compound (Va) has been assigned the structure as 2-p-tolylimino-5-imino-1,3,4-thiadiazolidine. The other compounds (Vb-f) were prepared by following the similar method (Table 1).



Where (I,II,III,IV,V)= R

a = p-tolyl, b = o-tolyl, c = m-tolyl

d = phenyl, e = o-chlorophenyl, f = p-chlorophenyl

Fig: 1

CONCLUSION

In conclusion, in present work some new 2-arylimino-5-imino-1,3,4-thiadiazolidine derivatives were prepared. The structures of all the synthesized compounds were confirmed on the basis of IR, 1H NMR, and mass spectral data. All the synthesized compounds are expected to show good biological activities.

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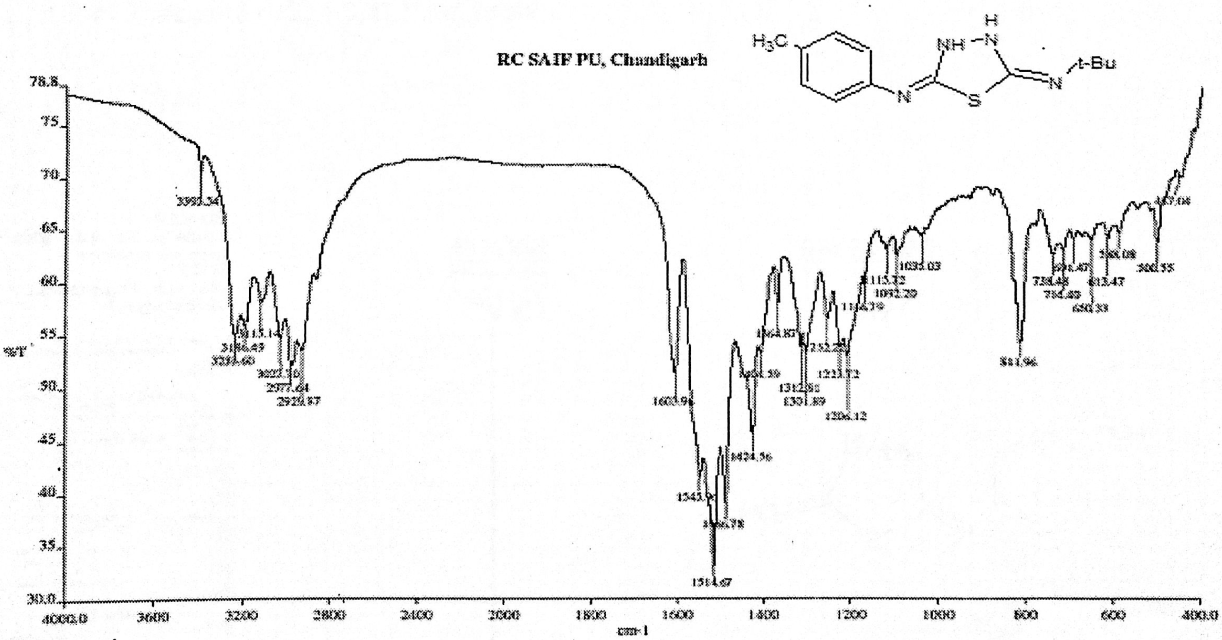
Table 1: Physicochemical Properties Data

Compound	Molecular Formula	% Yield	M.P ^{0}C
IIIa	$C_{13}H_{20}N_4S_2$	80	116
IIIb	$C_{12}H_{18}N_4S_2$	78	140
IIIc	$C_{13}H_{20}N_4S_2$	72	123
IIId	$C_{13}H_{20}N_4S_2$	75	125
IIIe	$C_{12}H_{17}N_4S_2Cl$	69	115
IIIf	$C_{12}H_{18}N_4S_2Cl$	70	128
IVa	$C_{13}H_{18}N_4S$	75	102
IVb	$C_{13}H_{18}N_4S$	62	116
IVc	$C_{13}H_{18}N_4S$	66	160
IVd	$C_{12}H_{16}N_4S$	71	142
IVe	$C_{12}H_{15}N_4SCl$	69	108
IVf	$C_{12}H_{15}N_4SCl$	72	153
Va	$C_9H_{10}N_4S$	70	121
Vb	$C_9H_{10}N_4S$	52	110
Vc	$C_9H_{10}N_4S$	56	130
Vd	$C_8H_8N_4S$	60	138
Ve	$C_8H_7N_4SCl$	65	114
Vf	$C_8H_7N_4SCl$	62	161



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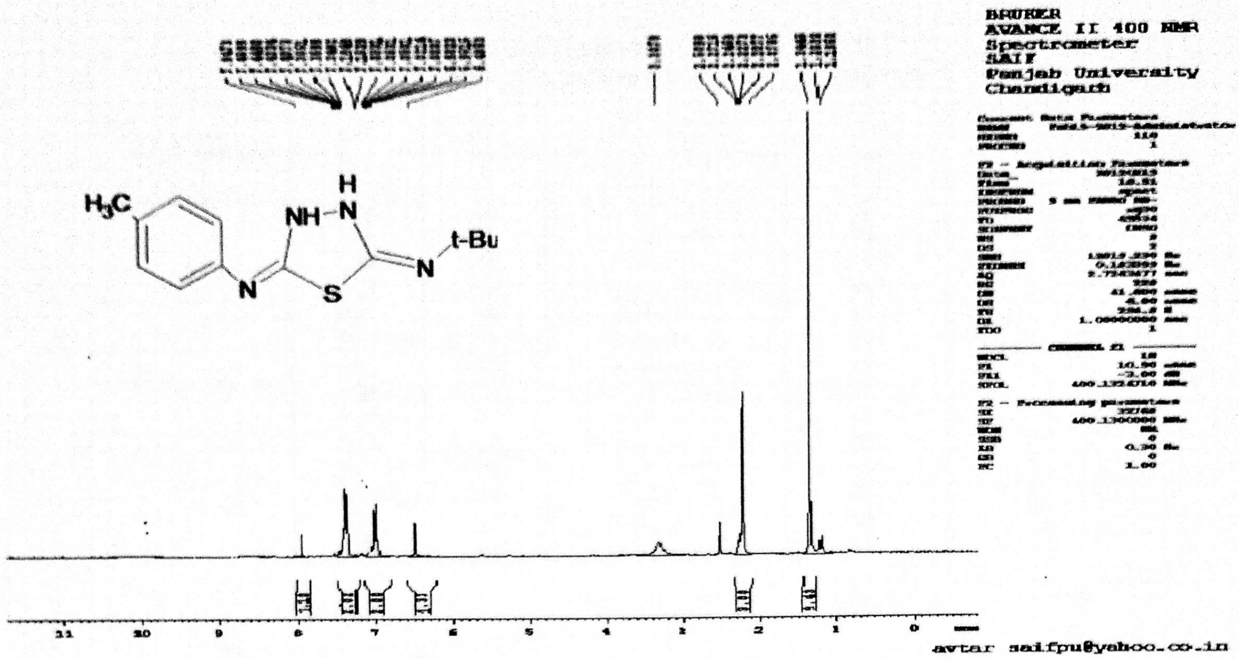

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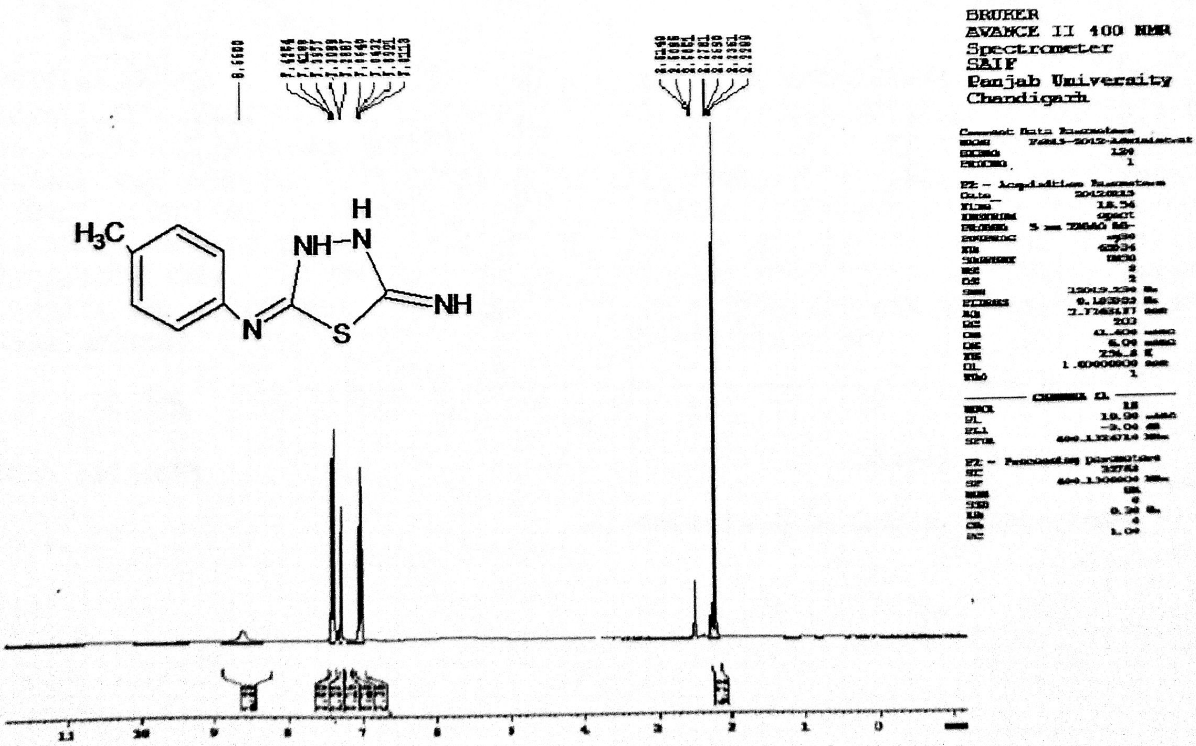

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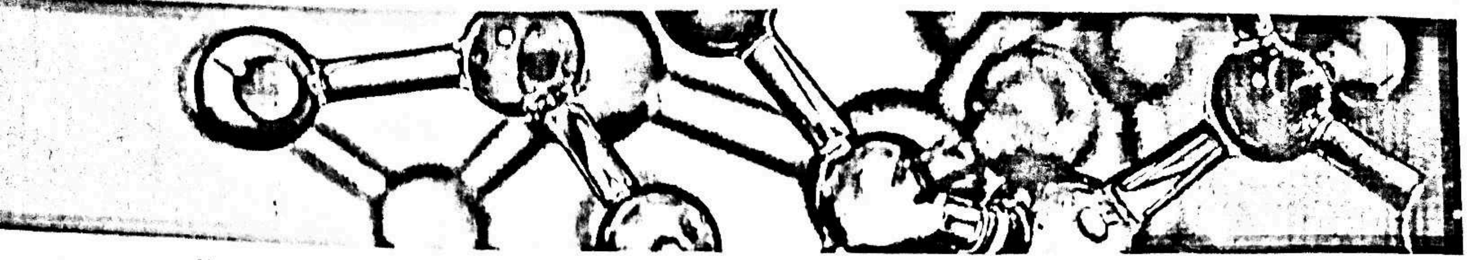

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Research Article

Synthesis of 2-Arylimino-5-Tert-Butylimino -1,3,4-Thiadiazolidines

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ABSTRACT

In the present study, we have synthesized some new 2-arylimino-5-t-butylimino-1,3,4-thiadiazolidines (IVa-f). The compounds (IVa-f) were prepared by the cyclo condensation of N-aryl thiosemicarbazide (IIa-f) and tert-butyl isocyanodichloride in chloroform medium. All the newly synthesized compounds were subjected to physical characterization and spectral analysis by IR and NMR & Mass for structure elucidation.

Keywords: 1,3,4-thiadiazole derivatives, tert-butyl isocyanodichloride, cyclo condensation.

INTRODUCTION

The five member heterocyclic compounds with three hetero atoms at symmetrical position have been extensively studied. 1,3,4-thiadiazole is one such compound and literature is enriched with it's various derivatives. exhibiting antifungal activities[1,9]. The different methods have been proposed for the synthesis of 1,3,4-thiadiazole and it's derivatives[7-9]. Herein synthesis of various substituted 1,3,4-thiadiazolidine by cyclo condensation reaction of N-aryl thiosemicarbazide and T-butyl isocyanodichloride have been proposed. The structures of synthesized compounds were established on the basis of IR and H^1-NMR spectra.

M ATERIAL AND METHOD

Melting points were determined in open capillaries in a liquid paraffin bath and are uncorrected. The purity of compounds was checked by TLC. IR spectra were recorded using KBr disc plate technique on a Bruker FT-IR spectrophotometer. ^{1}HNMR spectra (DMSO-d_6 and $CDCl_3$) were carried out on a Bruker Advance 400 MHz spectrometer using TMS as internal reference (chemical shifts in ó, ppm).

The reagents aryl isothiocyanate[10], T-butyl isocyanodichloride[11] were prepared by following previously reported methods.

N-aryl thiosemicarbazide(IIa-f)[12-13] required for the synthesis of 2-arylimino-5-t-butylimino-1,3,4-thiadiazolidines (IV) were prepared as below.

Preparation of N-p-tolyl thiosemicarbazide[12,13] (IIa)

The p-tolyl isothiocyanate (Ia) (0.01 mol) was dissolved in 20 ml chloroform and hydrazine hydrate (99%) (0.01 mol) was added drop wise to the reaction mixture with stirring. The reaction was found to be exothermic. The resulting mixture was allowed to cool. The white solid separated within 10 minutes, was filtered, washed with water and dried. The product (IIa) was recrystallized from ethanol, yield 76% ,m.p 158 ^{0}C.

(IIa) : **IR spectra**14: (KBr) cm-1: 3296 (NH), 1619 (C=N), 1275 (C-N), 1178(C=S); **1H-NMR** (DMSOd6) ppm: 2.2(3H, s, Ar-CH3), 4.2 (2H, bs, N-H) 7.2-7.06 (2H, d, Ar-H), 7.03-7.37 (2H, d, Ar-H), 8.6(1H, s, N-H) .

The other **N**-Aryl thiosemicarbazide (IIb-f) were prepared by extending the above reaction to different aryl isothiocyanates (Ia-f).

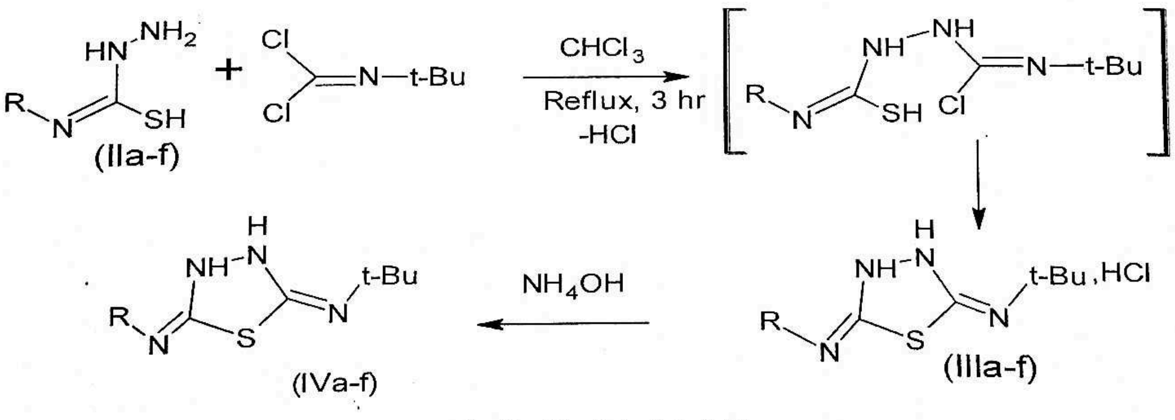
Preparation of 2-p-tolylimino-5-t-butylimino-1,3,4-thiadiazolidine (IVa)

N-p-tolyl thiosemicarbazide (IIa) (0.01 mole) was refluxed with tert-butyl isocyanodichloride (0.01 mole) in chloroform medium over water bath for 3.0 hr. The evolution of hydrogen chloride gas was clearly noticed. On cooling the reaction mixture and distilling off chloroform afforded a sticky mass, which on washing repeatedly with petroleum ether (60-80°C) gave a granular solid, crystallised from ethanol. It was acidic to litmus and on determination of equivalent weight, it was found to be a monohydrochloride (IIIa), yield 78%, m.p. 72-74°C. It, on basification with dilute ammonium hydroxide solution afforded a free base, (IVa). It was crystallised from ethanol, m.p. 102°C.The compound was insoluble in water but soluble in organic solvents and found to be non-

desulphurizable when boiled with alkaline lead acetate solution.
molecular formula was found to be $C_{13}H_{18}N_4S$.
(IVa) : **IR spectra**14: (KBr) cm-1: 3392 (NH), 3228(NH), 3180-3112(Ar-H), 3026-2980 (C-H, t-Bu), 2918,2856(C-H),1487 (C=N), 1313 (C-N), 810 (C-S); **1H-NMR** (DMSOd6) ppm: 1.2-1.4 (9H, m, t-Bu), 2.1(3H, s, CH3) 6.92-7.2 (4H, m, Ar-H), 7.3 (1H, d, NH), 7.4(1H, d, NH)
(IVc) IR: (KBr) cm-1 3391(N-H) 3195-3138(Ar-H), 2969-2795 C-H),1613 (C=N), 1167 (C-N), 774(C-S); **1H-NMR** (DMSOd6) ppm: 1.2-1.6 (9H, m, t-Bu), 2.1(3H, s, CH3) 6.92-7.2 (4H, m, Ar-H), 7.4 (1H, d, NH), 8.4(1H, d, NH).
On the basis of chemical properties and spectral data, the compound (IVa) has been assigned the structure, 2-p-tolylimino-5-t-butylimino-1,3,4-thiadiazolidine (IVa). On extending the above reaction to other **N**-Aryl thiosemicarbazide (IIb-f), the related products were isolated in good yield. (Table-1)

RESULT AND DISCUSSION

The synthetic route is outlined in *Fig*. 1
Six substituted aryl isothiocyanate[10] (Ia-f) and T-butyl isocyanodichloride[11] were prepared as reported earlier. N-aryl thiosemicarbazides[12-13] (IIa-f) was prepared as under.
The N-p-tolyl thiosemicarbazide (IIa) was prepared by the treatment of p-tolyl isothiocyanate(Ia) with hydrazine hydrate in chloroform medium. The reaction was found to be exothermic. The resulting mixture was allowed to cool. The white solid separated within 10 minutes, was filtered, washed with water and dried. The product (IIa) was recrystallized from ethanol, yield 76% ,m.p 158 ^{0}C.
The condensation of N-p-tolyl thiosemicarbazide (IIa) (0.01 mole) with tert-butyl isocyanodichloride (0.01 mole) in chloroform medium was carried out for 3.0 hr. The evolution of hydrogen chloride gas was clearly noticed. On cooling and distilling off chloroform a sticky mass obtained, which was repeatedly washed with petroleum ether (60-80°C) gave a granular solid and crystallized from ethanol. It was acidic and found to be a monohydrochloride (IIIa) on titrimetric analysis, yield 78%, m.p. 72-74°C. It, on basification with dilute ammonium hydroxide solution afforded a free base, (IVa). It was crystallised from ethanol, m.p. 102°C.The compound was insoluble in water but soluble in organic solvents and found to be non-desulphurizable when boiled with alkaline lead acetate solution. The infrared spectra of compounds **(IIa)** showed a characteristic strong absorptionat 1178 cm^{-1} attributable to the C=S of the thiourea residue. The cyclo condensation of (IIa) afforded substituted 1,3,4-thiadiazole(IVa). In the IR spectra of substituted 1,3,4-thiadiazole the absence of signals in the region 1400-1000 cm^{-1} established the lack of a C=S group. Also the H^1-NMR spectra of the compound (IVa) supported the structure of the substituted 1,3,4-thiadiazole.



Where R - (I, II, III, IV, V, VI)
a= p- tolyl, b= phenyl, c = o-tolyl, d=m-tolyl,
e= o-chloro phenyl, f=p-chloro phenyl

Fig-1

Table 1: Physicochemical Properties Data

Compound	Molecular Formula	% Yield	M.P °C
IIa	$C_8H_{11}N_3S$	76	158
IIb	$C_7H_9N_3S$	81	130
IIc	$C_8H_{11}N_3S$	79	140
IId	$C_8H_{11}N_3S$	75	105
IIe	$C_7H_8N_3SCl$	71	120
IIf	$C_7H_8N_3SCl$	68	165
IVa	$C_{13}H_{18}N_4S$	78	102
IVb	$C_{13}H_{18}N_4S$	80	144
IVc	$C_{13}H_{18}N_4S$	75	115
IVd	$C_{12}H_{16}N_4S$	67	164
IVe	$C_{12}H_{15}N_4SCl$	65	110
IVf	$C_{12}H_{15}N_4SCl$	81	156

CONCLUSION

2-arylimino-5-t-butylimino-1,3,4-thiadiazolidines (IVa-f) were successfully prepared by the cyclo condensation of N-aryl thiosemicarbazide (IIa-f) and tert-butyl isocyanodichloride in chloroform medium. The structures of the synthesized compounds were established on the basis of chemical properties and IR and NMR spectral data. These compounds are expected to show antimicrobial properties.

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EFFECT OF ISOTONIC AND ISOMETRIC TRAINING ON THE PERFORMANCE OF COLLEGE GOING GIRLS

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ABSTRACT

Many people participate in sports and games for fun, happiness, pleasure for health and fitness. Increased participation in sports has resulted in competition which has become an important element of modern life. Competition provides the means by which one can show one's worth by competing successfully. For top level performance, it is very important to spot, select and nurture a budding sportsman as it is recognized by all that athletes must possess some inherent qualities, which can be developed by means of systematized and scientific training.

INTRODUCTION

Now day's sports become a part and parcel of life. Millions of fans follow different sports events all over the world with an enthusiasm boarding in devotion. Many people participate in sports and game of happiness, pleasure, competition which has become an important element in modern life.

Isotonic Exercise

Many athletes who work out regularly are not familiar with the technical term, but most of them are familiar with the actual practice of isotonic and isometric exercise. Isotonic and isometric exercise is when the muscle carries a static weight limit over a specific rang of motion. In common terms, this means moving a free weight of fixed weight as part of common weight training. A bicep curl is a classic example of isotonic exercise, where the muscle has to work against a set resistance through the entire curl, which is the range of motion.

Isotonic exercise is very useful, not only in helping participants bulk up, but in providing specific muscle responses that will be useful in range of athletic and recreational activities.

One of the main benefits of isotonic exercise is that it doesn't require extensive equipment. Benefits of isotonic exercise are that it doesn't require extensive equipment. Portable items like dumbbells, kettle bells, medicine balls and other similar tools are all ways to fit isotonic exercise into any space of environment. More of the benefits and isometric exercise are related to the use of resistance. The weight of the above fitness tools provides resistance that the body has to work against. This helps strengthen muscles in several ways.

Isometric Exercise

Isometric exercise involves no joint movement, shortening or lengthening of a muscle. Some examples of isometric exercise include pushing or pulling against an immoveable object, working one muscle against another muscle, and holding yourself in a static pose for as long as you can. This form of exercise will increase your muscles strength and endurance but only in the pose that is being held. Isometric exercise are contractions of a particular muscle or group of muscles. During isometric exercises, the muscle doesn't noticeably change length and the affected joint doesn't move. Isometric exercises don't effectively build strength but can help maintain muscle strength most often in rehabilitative setting. Because isometric exercises are done in one position without movement, they'll improve strength in only one particular position. You'd have to do various isometric exercises through your limb's whole range of motion to improve muscle strength across the range. In addition, since isometric exercises are done in a static position, they won't help improve speed or athletic performance.

Purpose of the Study

The main purpose of present this paper is to determine the effect of Isotonic and Isometric Training on the performance of college going girls.

Objectives

The main objectives of present this paper is to

i. Find out the effect of Isotonic Training on the cardio-vascular endurance performance of college girls.
ii. Find out the effect of Isometric Training on the cardio-vascular endurance performance of college girls.

Methodology

Selection of Test and Criterion Measure

1. 12 Minute run/walk test

Administration of tests

Cardio-Vascular Efficiency : (Coopers 12 minute and walk)

Purpose – To Measure the cardio-vascular endurance.

Equipment – Stopwatch or clock with sweep second hand.

Producer

The subjects stood behind the starting line of the running space on 400 mts. Track. The running space was divided in sixteen equal parts to facilitate measuring the distance run by the subjects. The subjects were divided into two groups and each one is having one partner from another group. The subjects were made to run in their respective groups and the partner of each student from other group recorded the distance covered by their partners in 12 minute run/walk. They were given standing start and the race started on the sound on the clapper. The subjects ran/walked to their best, for 12 minutes on the said track and at the end of 12th minute a long whistle was blown which would the indication to stop where ever they were then. The distances were measured accordingly in mts. The same procedures were adopted for the next group subjects too.

Collection of Data

For data collection two test was conducted as given below, administration of the test 1) Pre-test: A Ore-test was conducted for knowing the equal distribution of both the group ie. Two Experimental groups and control group. 2) Post-test: After six weeks training programmed final test was conducted for the final result collected pre-test and post test data was further put for analysis.

Analysis and Interpretation

The researcher conducted and research paper on effect of Isotonic and Isometric exercises on cardio-vascular endurance performance of college girls. For the purpose of this study the researcher collected data on 60 college girls of Yavatmal city.

Analysis of Data

To determine the significant difference in the means of Cardio-Vascular endurance of college girls between the three groups as well as between the pre-test and post test means of two experimental and control group t-test was employed.

Level of Significance

To find out the significance difference, level of significance was set at 0.05 level of confidence.

Findings of the statistical analysis have been shown in the following tables.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 min Run/ Walk Test Between the Means of Pre and Post-tests of Control Group

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Pre-test	1465.750	70.174	10.500	22.080	0.476@
Post-test	1476.250	69.469			

@ Not significant at 0.05 level Tabulated t0.05(19)= 2.093

The above Table 1 show that, 12 min run/walk test mean difference between the pre-test and post test of control group is not significant, because the calculated t-value of 0.476 is less than the tabulated t-value of 2.093 at 0.05 level of confidence of 19 degree of freedom.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 Min Run/Walk Test Between the Means of Pre and Post-tests of Isotonic Group

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Pre-test	1466.00	71.393	74.00	22.579	3.277*
Post-test	1540.00	70.859			

* Significant at 0.05 level Tabulated t0.05(19)= 2.093

The above Table 2 show that, 12 min run/walk test mean difference between the pre-test and post test of Isotonic group is significant, because the calculated t-value of 3.277 is greater than the tabulated t-value of 2.093 at 0.05 level of confidence of 19 degree of freedom.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 Min Run/Walk Test Between the Means of Pre and Post-tests of Isometric Group

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Pre-test	1465.00	76.466	79.500	25.162	3.159*
Post-test	1545.00	82.558			

* Significant at 0.05 level Tabulated t0.05(19)= 2.093

The above Table 3 show that, 12 min run/walk test mean difference between the pre-test and post test of Isometric group is significant, because the calculated t-value of 3.159 is greater than the tabulated t-value of 2.093 at 0.05 level of confidence of 19 degree of freedom.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 Min Run/Walk Test Performance Between the Means of Post-tests of Isotonic and Control Groups

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Isotonic	1540.00	70.859	63.750	22.189	2.873*
Control	1476.250	69.469			

* Significant at 0.05 level Tabulated t0.05(38)= 2.024

The above Table 4 show that, 12 min run/walk test mean difference between the post test of Isotonic and Control group is significant, because the calculated t-value of 2.873 is greater than the tabulated t-value of 2.024 at 0.05 level of confidence of 38 degree of freedom.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 Min Run/Walk Test Between the Means of Post-tests of Isometric and Control Groups

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Isotonic	1540.00	82.558	68.750	24.127	2.850*
Control	1476.250	69.469			

* Significant at 0.05 level Tabulated t0.05(38)= 2.024

The above Table 5 show that, 12 min run/walk test mean difference between the post test of Isometric and Control group is significant, because the calculated t-value of 2.850 is greater than the tabulated t-value of 2.024 at 0.05 level of confidence of 38 degree of freedom.

Summary of Mean, Standard Deviation and t-ratio for the Data on 12 Min Run/Walk Test Between the Means of Post-tests of Isometric and Isometric Groups

Test	Mean	Standard Deviation	Mean Difference	Standard Error	t-ratio
Isotonic	1540.00	70.859	5.00	24.328	0.206@
Isometric	1545.00	82.558			

@ Not Significant at 0.05 level Tabulated t0.05(38)= 2.024

The above Table 6 show that, 12 min run/walk test mean difference between the post test of Isometric and Isometric groups is not significant, because the calculated t-value of 0.206 is less than the tabulated t-value of 2.024 at 0.05 level of confidence of 38 degree of freedom.

Discussion on Findings

- Insignificant difference in pre test and post test of control group in12 min Run/Walk Test (t= 0.476) is less than the tabulated t-value of 2.093 at 0.05 level of confidence of 19 degree of freedom and in Isotonic and Isometric groups (t = 0.206) is less than the tabulated t-value of 2.024 at 0.05 level of confidence of 38 degree of freedom.
- Significant difference in pre test and post test of Isotonic group in 12 min Run / Walk test (t = 3.277), is greater than the tabulated t-value of 2.093 at 0.05 level of confidence of 19 degree of freedom.
- Also significant difference in post test of Isotonic – Control Groups (t = 2.873)and Isometric- Control groups (t = 2.850)in 12 min Run / walk test, are greater than the tabulated t-value of 2.024 at 0.05 level of confidence of 38 degree of freedom.

Justification of Hypothesis

Research hypothesized that; there would be significant effect of isotonic and isometric training on the cardio-vascular endurance performance o college girls.

From the above finding there was significant difference found in pre-test and post-test in Isotonic and Isometric groups also in post test of Isotonic-Control and Isometric-Control groups in 12 min run /walk test, hence researcher hypothesis was accepted.

Conclusion

In the conclusion the effect of Isotonic and Isometric exercise on college girls on the cardio-vascular endurance following conclusion was drawn.

- Insignificant difference in pre-test and post-test of control group and Isotonic-Isometric groups in 12 min Run/walk Test.
- Significant difference observed in pre test and post test of Isotonic group in 12 min Run/Walk test.
- Also significant difference found in pre test and post test of Isometric group in 12 min Run/walk test.
- Also significant difference in post test of Isotoni9c- Control groups and Isometric-Control groups in 12 min Run/walk test.
- Because of Isotonic and Isometric training cardio-vascular endurance of the college girls increases hence showed the significant.

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Content

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Social impacts On Olympic Games

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Introduction

This section of the OGIS considers the potential social impacts of hosting the Olympics. It examines the impacts on three accounts:

- people, skills and employment;
- the sporting and cultural legacy: this account includes the so-called 'feel good factor' although arguably this impact is also relevant to other accounts; and
- public health which includes socio-economic, physical, mental and well-being health.

People, skills and employment

Baseline position

In considering the potential impacts of the Olympics in terms of people, skills and employment, especially the local level impacts within the Lower Lea Valley and North East London more generally, it is important to have regard to the baseline conditions in the area. One way of doing this is by examining the results of the ODPM's Index of Multiple Deprivation (IMD) employment deprivation, health deprivation and disability, education, skills and training deprivation, barriers to housing and services, living environment deprivation and crime. Two supplementary indices consider income deprivation affecting children and income deprivation affecting older people.

Employment

Staging the Olympic Games in the Lower Lea Valley will stimulate a vital economic regeneration programme in London's poorest and most disadvantaged area. The Olympic Park will provide local people with significant improvements in job opportunities, education and skills and training.

The University of Nottingham's analysis of the economic impact of hosting the Olympics in London has estimated the potential impact on employment in the UK, London and East London. Table 10 summarises the key results4. The number of full time equivalent ('fte') jobs likely to be created or supported by the anticipated increases in expenditure and investment between 2005 and 2016 ranges from 38,000 ftes in London and 8,000 ftes in the UK as a whole. In interpreting these results, it is important to recognise that they effectively double-count the impact on GDP.

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The role of the Olympics in supporting regeneration of North East London and ensuring a sustainable legacy from hosting the Olympics is apparent from the types of social impacts that could be generated as a result of hosting the Olympics (compared to a 'without Olympics' scenario). Evidence of the social benefits from various sports-related initiatives across the UK suggests that the Olympics could be instrumental in supporting wider regeneration polices, for example by:

- empowering disadvantaged groups through employment opportunities related to the Olympics;
- improving employment prospects through experience gained before and during the Olympics; and,
- increasing social integration and co-operation through development of local enterprise and other initiatives focused on the Olympics.

Such effects could also influence crime rates, educational attainment and overall community well-being and sense of place.

Sporting and cultural legacy

As a result of hosting the Olympics in 2012, London is expected to benefit from a significant sporting and cultural legacy.

Sporting legacy

The sporting legacy would take a number of forms:

- it would enhance and/or accelerate investment in sporting facilities not only within the Olympic Zone (and the areas immediately surrounding it) but also in other parts of the UK, for example where training facilities are provided; and
- it would contribute to increased participation in sport, and this would be expected to lead to knock-on social and physical impacts, for example in terms of health and well-being.

The potential physical legacy of the Olympics is evident from London's candidate file which identifies the additional venues which will be either constructed or refurbished specifically for the Olympics. It shows that the Olympics will provide an opportunity to enhance the sports infrastructure of the UK, and London in particular. The cluster of sport venues in the Lea Valley retained after the Games will form The London Olympic Institute. Specific plans for the facilities to be retained in the Park include:

- the Olympic Stadium which will be converted to a 25,000 seat multipurpose venue with athletics at its core and which will offer training facilities, offices and sports science and sports medicine facilities;
- an aquatics centre with two 50m pools, a 25m diving pool and fitness centre which will accommodate elite, development, local club and community users and will have a permanent capacity for 3,500 spectators;
- a velopark, a multi-discipline cycling centre, that includes a 3,000 seat velodrome, a road track, competition and recreational BMX tracks and a mountain biking course for use by all levels of cyclists;

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- a hockey centre providing training and competition facilities for hockey at all levels; and
- an indoor sport centre which will be converted from one of the sports arenas to become a training and competition venue and a regional home for a range of indoor sports, with flexible seating for up to 10,000.

The London Olympic Institute will be accessible for all levels of ability and blend sport, culture and the environment in a way that makes sports an integral part of the community.

The social and economic value of these facilities has not been directly assessed.

In addition, the Olympics will potentially provide a focus for achieving wider Government targets in relation to improved health through sporting activity. For example, as indicated in the 'London Plan for Sport and Physical Activity 2004 to 2008', it is hoped that the Olympics will act as an 'inspiration' to people increasing their participation in sport and, subsequently, maintaining this interest with resultant benefits in terms of productivity, health and community engagement. No substantive work has, however, been done to quantify the potential legacy impacts on sporting participation.

Cultural legacy

The Olympic Park will provide local people with significant improvements in cultural entitlements and social integration. The Olympics will also promote accessibility and inclusion, important objectives in such a diverse city as London. In particular, it will accelerate the development of accessible facilities for disabled people. The Olympics will also strengthen and enrich cultural activity, building on the rich heritage of east London and providing new opportunities and facilities for the creative industries.

'Willingness to pay'

One important input to the OGIS has been a study designed to assess people's 'willingness to pay' for the intangible benefits associated with hosting the Olympics in London6. The key results of the study are summarized in Table 11. For the UK as a whole, the value of the intangible benefits of hosting the Olympics are estimated to be £3.2 billion, with approaching 80% of this benefit accruing to households living outside London. This implies that, on average, London households are willing to pay £22 each per annum for 10 years in order to host the Olympics whereas households in Glasgow and Manchester, the two other locations where fieldwork was undertaken besides London, are willing to pay £12 per household per year over the same period.

Public health

The potential impacts of the Olympics on public health have been assessed qualitatively using a Rapid Health Impact Assessment7. This reflects the dearth of relevant quantitative data.

The research examined four categories of impact largely based on a literature review and a series of consultations and workshops with key stakeholders, especially within London:

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- the socio-economic health impact which takes into account how potential socio-economic developments affect public health through their effects, for example, on levels of income and job security, on social cohesion and on access to housing and education;
- the physical health impact which traces the effects of changes in the quality of the physical environment, the amenity and the transport system;
- the mental health impact which reflects individuals' ability to balance all aspects of life arising from their social, economical, physical and emotional interactions by managing their surroundings and making choices throughout their lives; and
- the well-being health impact which reflects the extent to which individuals (expect to) feel contented (i.e. happy, healthy and prosperous): a negative impact can be reflected in depression, anxiety and stress. By its very nature, the scope of the public health impact assessment is broad and there are strong links and interdependencies with other dimensions of the framework used for the OGIS. Consequently, care is needed to check for consistency between the impacts and to avoid double counting.

Baseline conditions

As context for considering the potential impacts of the Olympics on public health, especially the local level impacts within the Lower Lea Valley and North East London more generally, it is useful to look at the evidence from the ODPM's IMD. Table 12 shows the marked levels of deprivation in relation to health in and around the Olympic Zone: 32% of the SOAs in the Olympic Zone and 14% of those in the five Olympic Boroughs are amongst the 10% most deprived in England.

Summary

Overall, the public health impacts appear to be significantly positive, particularly during the Olympics and the legacy phase. These benefits are experienced most strongly in the Lower Lea Valley as a result of improved access to new sporting and health care facilities. The health benefits are, however, anticipated to extend to London and across the UK as a whole due to the general promotion of physical and sporting activity.

Conclusions

Staging the Olympic Games in the Lower Lea Valley will stimulate a vital economic regeneration programme in London's poorest and most disadvantaged area. In total, the number of full time equivalent ('fte') jobs likely to be created or supported by the Olympics between 2005 and 2016 is 38,000 ftes in London and 8,000 ftes in the whole of the UK. In interpreting these results, it is important to recognize that they effectively double-count the impact on GDP.

The Olympics may also create sustainable social impacts, for example by empowering disadvantaged groups through employment opportunities, improving employment prospects through experience gained before and during the Olympics and increasing social integration and co-operation through development of local enterprise and other initiatives focused on the Olympics. Such effects could also influence crime rates, educational attainment and overall community well-being and

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sense of place. By hosting the Olympics in 2012, London expects to achieve a significant sporting and cultural legacy. The sporting legacy would take a number of forms:

- It would enhance and/or accelerate investment in sporting facilities not only within the Olympic Zone but also in other parts of the UK; and
- It would contribute to increased participation in sport.

The potential physical legacy of the Olympics is evident from London's candidate file which identifies the additional venues which would be either constructed or refurbished specifically for the Olympics. It shows that the Olympics will provide an opportunity to enhance the sports infrastructure of the UK, and London in particular.

Analysis of individuals 'willingness to pay' for the intangible benefits associated with hosting the Olympics in London indicates that for the UK as a whole, the value of the benefits is £3.2 billion, with approaching 80% of this benefit accruing to households living outside London. This implies that, on average, London households are willing to pay £22 each per annum for 10 years in order to host the Olympics whereas households in Glasgow and Manchester, the two other locations where fieldwork was undertaken besides London, are willing to pay £12 per household per year over the same period.

These intangible benefits are effectively additional to the impacts on GDP although they double-count some of the other impacts assessed in the OGIS.

The most important intangible benefits identified in the research are those which have the broadest appeal (i.e. the uniting of people, the creation of a 'feel good factor', enhanced national pride, motivating/inspiring children and the legacy of sports facilities). Analysis of the perceived intangible disbenefits suggests that the most important are those which are expected to be relatively short-lived (i.e. they will arise during the Olympics and in the immediate period before and after the Olympics).

Overall, the public health impacts appear to be significantly positive, particularly during the Olympics and the legacy phase. These benefits are experienced most strongly in the Lower Lea Valley as a result of improved access to new sporting and health care facilities. The health benefits are, however, anticipated to extend to London and across the UK as a whole due to the general promotion of physical and sporting activity.

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CONTENTS

GOODS AND SERVICES TAX(GST)

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Introduction

Goods and Services Tax (GST) is a proposed system of indirect taxation in india merging most of the existing taxes into single system of taxation. It was introduced by the constitution Act 2016. The chairman of BST bill is union finance minister which is currently Arun Jaitley.

GST would be a comprehensive indirect tax on manufacturer, sale and consumption of goods and services throughout india, to replace taxes levied by the central and state governments. Goods and services tax would be levied and collected at each stage of sale or purchase of goods or services based on the input tax credit method. This method allows GST registered businesses to claim tax credit to the value of GST they paid on purchase of goods or serveices as part of their normal commeredial activity. Taxable goods and services are not distinguished from one another and are taxed at a single ratae in a supply chain till the goods or services reach the consumer. Administrative responsibility would generally rest with a single authority to levy tax on goods and services. The introduction of goods and services tax(GST) would be a significant step of in the reform of indirect taxation in india.

What is GST?

GST (Goods & Services Tax), which is also known as VAT or the value added tax in many countries is a multi-stage consumption tax on goods and services.

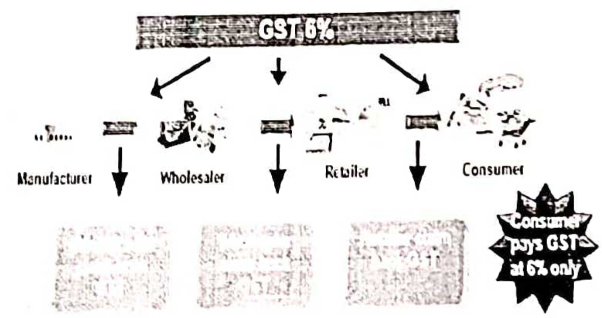
GST is levied on the supply of goods and services at each stages of the supply chain from the supplier up to the retail stage of the distribution. Even though GST is imposed at each level of the supply chain, the tax element does not become part of the cost of the product because GST paid on the business inputs is claimable.

Hence, it does not matter how many stages where a particular good and service goes through the supply chain because the input tax incurred at the previous stage is always deducted by the businesses at the next in the supply chain.

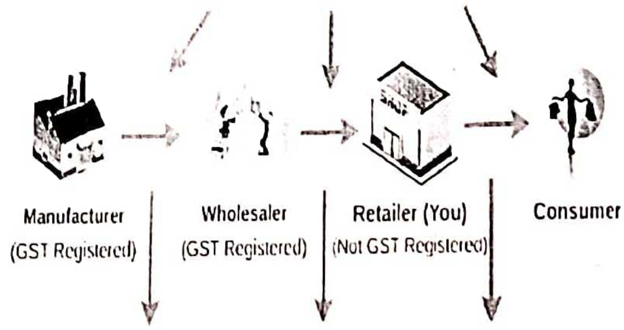
GST is a broad based consumption tax covering all sectors of the economy i.e all goods and services made in Malaysia including imports except specific goods and services which are categorized under zero rated supply and exempt supply orders as determined by the Minister of Finance and published in the Gazette.

The basic fundamental of GST is it's self-policing features which allow the businesses to claim their input tax credit by way of automatic deduction in their accounting system. This eases the administrative procedures on the part of businesses and the Government. Thus, the Government's delivery system will be further enhanced.

Understanding GST Concept & Fundamental



Retailer (You) is not GST registered GST 6%



	Sales price	RM100,000	Sales price	RM150,000	Sales price	RM17500
Assume manufacturer's GST for purchases is RM2,000	Add GST 6%	RM6,000	Add GST 6%	RM9,000	Add GST 6%	Not applicable
	Total	RM106,000	Total	RM159,000	Total	RM17500

	Input tax credit	RM12,000	Input tax credit	RM6,000	Input tax credit	can't claim
	GST remit	RM4,000	GST remit	RM3,000	Cost increased	RM9,000
	(6,000-2000)		(9,000-6000)		Cost increased	N/A

You cannot claim back for the RM9,000 of GST you paid to your wholesaler.
You cannot charge GST on Consumer.

Scope and Charge

"GST is to be levied and charged at the proposed rate of 6% on the value of the supply. GST can be levied and charged only if the business is registered under GST.

GST shall be levied and charged on the taxable supply of goods and services made in the course or furtherance of business in Malaysia by a taxable person. GST is also charged on the importation of goods and services. A taxable supply is a supply which is standard rated or zero rated. Exempt and out of scope supplies are not taxable supplies.

GST is to be levied and charged at the proposed rate of 6% on the value of the supply. GST can be levied and charged only of the business is registered under GST. A business is not liable to be registered of its annual turnover of taxable supplies does not reach the prescribed threshold. Therefore, such businesses cannot charge and collect GST on the supply of goods and services made to their customers. Nevertheless, businesses can apply to be registered voluntarily.

GST is a better tax system compared to SST (Sales & Service Tax)

1. **Lower business cost**
   Under the current system, some business pay multiple taxes and higher levels of tax-on-tax (cascading tax). With GST, businesses can benefit from recovering input tax on raw materials and incurred expenses, thus reducing costs.
2. **Increase global competitiveness**
   Prices of Malaysia exports will become more competitive on the global stage as no GST is imposed on exported goods and services, while GST incurred on inputs can be recovered along the supplies chain. This will strengthen our export industry, helping the country progress even further.
3. **Enhance compliance**
   The current SST has many inherent weaknesses making administration difficult. GST system has in-built mechanism to make the tax administration self-policy and therefore will enhance compliance.
4. **Reduces red tape**
   Under the present SST, businesses must apply for approval to get tax-free materials and also for special exemption for capital goods. Under GST, this system is abolished as businesses can offset automatically the GST on inputs in their returns.
5. **Equity**
   With GST, taxes are leveled fairly among all the businesses involved, whether they are in the manufacturing, wholesaling, retailing or service sectors.
6. **Fair pricing to consumers**
   GST eliminates double taxation under SST. Consumers will pay fairer prices for most goods and services compared to SST.
7. **Greater transparency**
   Unlike the present sales tax, consumers would benefit under GST as they will know exactly whether the goods they consume are subject to tax and the amount they pay for.

Benefit to Consumers

Suppliers,manufacturers,wholesalers and retailers are able to recover GST incurred on inputs. This reduces the cost of doing business, thus enabling fairer prices for consumers.

Certain basic goods and services are not subject to GST for socio-economic objectives. These include basic foods, residential accommodation, education, health services, public transportation, and domestic consumption of water supply and electricity up to a certain limit.

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Article

Two-Fluid Cosmological Models in Scalar-Tensor Theory of Gravitation

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Abstract

In this paper, we have investigated two-fluid Kantowski-Sachs cosmological models with matter and radiating source in the scalar-tensor theory of gravitation proposed by Saez and Ballester. Two-fluid model in Saez and Ballester theory of gravitation, one fluid represents the matter content of the universe and another fluid is the CMB radiation. To get the deterministic model, we have assumed that a relation between metric potentials $A = B^n$, where A and B are metric potentials and n is constant. We have also investigated the behaviors of some physical parameters.

Keywords: Two-fluid, Kantowski-Sachs, Saez, Ballester, gravitation.

1. Introduction

The cosmic evolution based on two-fluid big-bang model appears better than two sequences of a single fluid model. In these models, we have assumed that both the fluids are present throughout the cosmic evolution with one fluid dominating the other. Such type of models can be used to describe, the transition between a radiation dominated phase to a matter dominated phase as the universe evolves. Many researchers have formulated several aspects of two fluid cosmological models. Cosmological models with two fluids studied by McIntosh [1]. Coley and Dunn [2] have evaluated Bianchi type VI_0 model with two fluid sources. Pant and Oli [3] have investigated two-fluid Bianchi type II, cosmological models. Oli [4] has constructed Bianchi type-I two fluid cosmological models with a variable G and $\wedge$.

Qualitative analysis of two fluids FRW cosmological models has formulated by Verma [5]. Sandin [6] has examined Tilted two fluid Bianchi type-I models. Adhav et al. [7] have derived two fluid cosmological models in Bianchi type V space-time. Bianchi type IX two fluids cosmological models in General Relativity are developed by Pawar and Dagwal [8]. Kaluza-Klein mesonic cosmological model with the two-fluid source is investigated studied by Venkateswarlu [9]. Two-fluid cosmological model of Bianchi type-V with negative constant

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deceleration parameter studied by Singh et al.[10]. Samanta [11] have evaluated two fluid cosmological models in Kaluza-Klein space-time. Two fluid scenarios for dark energy model in a scalar-tensor theory of gravitation obtained by Reddy and Kumar [12]. Two fluids tilted cosmological model in General Relativity constructed by Pawar and Dagwal [13]. Axially Bianchi type-I Mesonic cosmological models with two fluid sources in Lyra Geometry presented by Pawar et al. [14]. Pawar and Dagwal [15, 16] have investigated Conformally flat tilted cosmological models and tilted Kantowski-Sachs cosmological models with disordered radiation in the scalar-tensor theory of gravitation proposed by Saez and Ballester. Recently Two fluid Axially Symmetric Cosmological Models in *f*(R, T) Theory of Gravitation, tilted Cosmological Models in *f*(R, T) Theory of Gravitation and tilted Kasner-Type Cosmological Models in Brans-Dicke Theory of Gravity formulated by Pawar and Dagwal [17-19].

2. Field Equation

We consider metric in the form –

$$ds^2 = -dt^2 + A^2\,dr^2 + B^2\left(d\theta^2 + \sin^2\theta\,d\phi^2\right), \tag{1}$$

where A and B are functions of t alone.

The Einstein's field equation is given by Saez and Ballester for the combined scalar and tensor field are

$$G_i^j - wV^h\left(V_{,i}V^{,j} - \frac{1}{2}g_i^j V_{,a}V^{,a}\right) = T_i^j, \tag{2}$$

and the scalar field satisfies the equation

$$2V^h V^{\,i}_{\;;j} + hV^{h-1}V_{,a}V^{,a} = 0\ , \tag{3}$$

where $G_i^j = R_i^j - \frac{1}{2}g_i^j R$ is Einstein tensor, h an arbitrary exponent and w a dimensionless coupling constant.

The energy-momentum tensor for the two fluid sources is given by

$$T_i^j = \overset{(m)}{T_i^j} + \overset{(r)}{T_i^j}\ . \tag{4}$$

Where $\overset{(m)}{T_i^j}$ is the energy-momentum tensor for matter field with the energy density ρ_m and pressure p_m and $\overset{(r)}{T_i^j}$ is the energy-momentum tensor for radiation field having energy density ρ_r and pressure $p_r = \left(1/3\right)\rho_r$, which are respectively given by

$$T_{ij}^{(m)} = \left(p_m + \rho_m\right) u_i^{(m)} u_j^{(m)} + p_m g_{ij}, \tag{5}$$

$$T_{ij}^{(r)} = \frac{4}{3}\rho_r u_i^{(r)} u_j^{(r)} + \frac{1}{3}\rho_r g_{ij}. \tag{6}$$

The four velocity vectors are given by $u_i^{(m)} = (0,0,0,1)$ and $u_i^{(r)} = (0,0,0,1)$ with
$g^{ij} u_i^{(m)} u_j^{(m)} = -1$ *and* $g^{ij} u_i^{(r)} u_j^{(r)} = -1$.

The field equation (2) for metric (1) reduce to

$$2\frac{B_{44}}{B} + \frac{B_4^2}{B^2} + \frac{1}{B^2} - \frac{wV^h}{2} V_4^2 = p_m + \frac{\rho_r}{3}, \tag{7}$$

$$\frac{A_{44}}{A} + \frac{B_{44}}{B} + \frac{A_4 B_4}{AB} - \frac{wV^h}{2} V_4^2 = p_m + \frac{\rho_r}{3}, \tag{8}$$

$$\frac{2A_4 B_4}{AB} + \frac{B_4^2}{B^2} + \frac{1}{B^2} + \frac{wV^h}{2} V_4^2 = -\left(\rho_m + \rho_r\right), \tag{9}$$

$$V_{44} + \left(\frac{A_4}{A} + 2\frac{B_4}{B}\right) V_4 + \frac{h}{2}\frac{V_4^2}{V} = 0 . \tag{10}$$

Here the index 4 after a field variable denotes the differentiation with respect to time *t*.

We assume an analytic relation between the metric coefficients as

$$A = B^n \tag{11}$$

where n is constant, and secondly we consider the equation of state, given by

$$p_m = \left(\gamma - 1\right)\rho_m . \tag{12}$$

Equation (7) and (8) leads to

$$B_{44}+\frac{(1+n)B_4^2+1}{B}=0. \tag{13}$$

$$2ff'+2\frac{\left[(1+n)f^2+1\right]}{B}=0 \tag{14}$$

Where

$$B_4=f(B) \quad , \qquad f'=\frac{df}{dB} \tag{15}$$

Integrating we get

$$f^2=(B_4)^2=\frac{c}{B^{2(n+1)}}-\frac{1}{n+1}, \tag{16}$$

where c is integration constant.

Hence the line element (1) reduced to

$$ds^2=-\frac{dB^2}{f^2}+B^{2n}dr^2+B^2\left(d\theta^2+\sin^2\theta d\phi^2\right). \tag{17}$$

Using co-ordinate transformation

$$ds^2=-\left[\frac{c}{T^{2(n+1)}}-\frac{1}{n+1}\right]^{-1}dT^2+T^{2n}dr^2+T^2\left(d\theta^2+\sin^2\theta d\phi^2\right), \tag{18}$$

where B = T .

3. Some Physical and Geometrical Property

Equation (10) , (11) and (16) leads to

$$V = \left[\frac{a_1}{T^{n+1}} \right]^{2/h+2} , \tag{19}$$

Where $a_1 = -\frac{c_1}{(n+1)T^{n+1}}$

The energy density ρ_m, pressure p_m for matter field and the energy density ρ_r for radiation field as

$$\rho_m = \frac{1}{(3\gamma-4)} \left[\frac{-6(n+1)}{T^{2(n+2)}} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right)^{-1/2} + \frac{2(2+n)}{T^2} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right) + \frac{4}{T^2} - \frac{wc_1^2}{T^{2(n+2)}} \left(\frac{c_1}{(1+n)T^{(n+1)}} \right)^{2/h+1} \right], \tag{20}$$

$$\rho_m = \frac{(\gamma-1)}{(3\gamma-4)} \left[\frac{-6(n+1)}{T^{2(n+2)}} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right)^{-1/2} + \frac{2(2+n)}{T^2} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right) + \frac{4}{T^2} - \frac{wc_1^2}{T^{2(n+2)}} \left(\frac{c_1}{(1+n)T^{(n+1)}} \right)^{2/h+1} \right], \tag{21}$$

and

$$\rho_r = \frac{6(n+1)}{(3\gamma-4)T^{2(n+2)}} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right)^{-1/2} - \left[\frac{2(2+n)}{(3\gamma-4)} + (2n+1) \right] \frac{1}{T^2} \left(\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right) - \left[\frac{4}{(3\gamma-4)} + 1 \right] \frac{1}{T^2} + \left[\frac{1}{(3\gamma-4)} - \frac{1}{2} \right] \frac{wc_1^2}{T^{2(n+2)}} \left(\frac{c_1}{(1+n)T^{(n+1)}} \right)^{2/h+1} . \tag{22}$$

The rate of expansion H_i in the direction of *x*, *y*, *z*-axis are given by

$$H_1 = \frac{2n}{T} \left[\frac{c}{T^{2(n+1)}} - \frac{1}{n+1} \right],$$

$$H_2 = H_3 = \frac{2}{T}\left[\frac{c}{T^{2(n+1)}} - \frac{1}{n+1}\right] \tag{23}$$

The scalar of expansion and shear scalar for the model are respectively given by

$$\theta = \frac{n+2}{T}\left[\frac{c}{T^{2(n+1)}} - \frac{1}{n+1}\right] \quad , \tag{24}$$

$$\sigma^2 = \frac{2}{3}\frac{(n-1)^2}{T^2}\left[\frac{c}{T^{2(n+1)}} - \frac{1}{n+1}\right]^2 \quad . \tag{25}$$

4. Conclusion

We have obtained two fluids Kantowski-Sachs cosmological models in the scalar-tensor theory of gravitation proposed by Saez and Ballester. Two fluids Kantowski-Sachs cosmological models are expanding and shearing universe but tilted Kantowski-Sachs cosmological models is only expanding and the non-shearing universe. When $T \rightarrow 0$, the scalar field V, the scalar of expansion and shear scalar, are undetermined but the large value of T the scalar field V, the scalar of expansion and shear scalar vanish. The scalar of expansion and shear scalar are vanished for $n = -2$ & $n = 1$. When $T = 0$, the rate of expansion H_i in the direction of *x*, *y*, *z*-axis is undetermined and the rate of expansion H_i in the direction of *x*, *y*, *z*-axis is vanished at $T = \infty$. At $\gamma = \frac{4}{3}$, the energy density ρ_m, pressure p_m for matter field are infinite. The pressure p_m for matter field vanishes at $\gamma = 1$. Since $\lim_{T \rightarrow \infty}\left(\frac{\sigma}{\theta}\right) \neq 0$ the models does not approach isotropy.

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