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Anticancerous Properties of the Biodiesels l Plant Jatropha Curcus

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Abstract: ***Jatropha, the unloved shrub has today become an agricultural and economic celebrity with the discovery that it may be the ideal biofuel crop, an alternative to the fossil fuels for a world which is moving towards a no oil age. It has been famous the world over because of its significance as a renewable source of bioenergy. Besides its toxicity its importance as a medicine for diseases like cancer, arthritis, scabies etc is also now known. In view of the immense potentiality of this plant as a good resource of bioenergy and for several therapeutic products it is recommended to produce genetically engineered plants for better usage of this wonder plant. Concerted efforts must be also done for further exploration of its properties so that this "Green Gold" fuel can be termed as a "Resurrecting" plant for our planet.***
Keywords: Biofuels, Jatropha, Anticancer, Toxicity, Biodiesel, Alkaloid.

I. INTRODUCTION

Jatropha as we all know is considered as one of the most promising plant as biodiesel. The Jatropha bush seems an unlikely prize in the hunt for alternative energy, being an ugly, fast growing and poisonous weed. Very soon it may power your car. This unloved shrub has today become an agricultural and economic celebrity with the discovery that it may be the ideal biofuel crop, an alternative to the fossil fuels for a world which is moving towards a no oil age.Jatorpha a native of Central America brought to Europe by Portuguese explorers in the 16th century and has since spread world wide. Jatropha is a large soft-wood, shrubby, drought resistant perennial plant, growing well even in the marginal or poor soil. It is easy to cultivate because it grows relatively quickly and keeps yielding seeds for some 50 years. The plant is also called as a humble, hardy tree. Jatropha is a shrubby tree with smooth grey bark which gives off a whitish coloured watery latex containing jatrophine when cut. Jatropha is a genus of Euphorbiaceae family with approximately 175 species that manifest as succulents, shrubs and tree. These plants are the natives of Africa, North America and the Caribbean regions. Jatropha was disseminated as a valuable hedge plant to Africa and India by the Portuguese traders. In many parts of the world the ancient systems of medicine have included Jatropha as a medicinal herb. This plant is prevalent in the Indian folklores with tremendous ethnobotanical significance. Jatropha is a very diverse subtropical and tropical genus which represents succulents and many interesting caudiciforms, herbaceous perennials and woody trees. Like all the members of the Euphorbiaceae family, Jatropha contains a milky sap that can irritate skin and can be extremely painful if it reaches the eyes.

II. CLASSIFICATION

Kingdom: Plantae
Sub-kingdom: Tracheobionta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Rosidae
Order: Euphorbiales
Family: Euphorbiaceae
Genus: Jatropha.L.
Species: curcas
: cinerea
: gossypifolia
: multifida
: podagrica
: integerrima
: glandulifera
: glauca

The seeds of Jatropha curcas when dry are dicotyledonous and dark brown in color with a weight of about 705 mg. The seeds resemble those of Ricinus communis in size and shape. Jatropha produces seeds with an oil content of about 35% that can be combusted as fuel after processing. (Table 1) It burns with clear smoke-free flame. It has been tested successfully as a fuel for simple diesel engines. The physico-chemical properties of the seed and seed oil of Jatropha gossipifolia were assessed by standard methods. The seed contains 35.8% crude oil of iodine value 107.25, 13.40% protein, 9.25% fibre, 30.32% carbohydrate and 6.0 g/kg saponins.[1]

Table 1 Physico-Chemical Composition Of Jatropha Seeds

S.No	Physico-Chemical properties	Percent
1.	Moisture	6.20%
2.	Protein	18.00%
3.	Fat	38.00%
4.	Carbohydrate	17.00%
5.	Fiber	15.50%
6.	Ash	5.30%

Non-edible oil of Jatropha along with several other plant seeds, including of Pongamia, Argemone, Mahua, Castor and Sal is being used to produce biodiesel.[2] Jatropha grows in many parts of India with minimum water inputs. It can grow well also under lower temperatures (temperate climate) and can withstand frost. In order to withstand drought the plant sheds most of the leaves to reduce loss of water through transpiration.

Many highly active compounds have been isolated from species of Jatorpha. These chemicals include terpenes, phytosterols, proteins, alkaloids and flavonoids. Stigmasterol from Jatropha shows strong anti-inflammatory activity when applied topically. [3] It reduces TPA-induced edema and inhibits metalloperoxidase activity. Alpha amyrin also exhibits anti-inflammatory activity. It is known to inhibit PKA (protein kinase A) as well as select proteases e.g. chymotrypsin which is inhibited by 18-alpha M of alpha-amyrin.[4] A novel diterpenoid, multidione, has been isolated from the stems of *Jatropha multifida* and its structure has been settled from 1D and 2D NMR spectra. The compound possesses a phenolic moiety and a long side chain, structurally similar to the B ring of other lathyrane-diterpenoids in seco-form. The compound has possibly been derived biogenetically from a related lathyrane-diterpenoid. [5][Table 2]

Table 2 Chemicals Obtainable From *Jatropha Curcas*

S.No	Chemical Constituents	Type
1.	7-keto β sitosterol	Phytosterol [35]
2.	α-Amyrin	Pentacyclic triterpene[35]
3.	Archidic acid	Eicosanoic acid[29])
4.	β sitosterol	Phytostero[28]
5.	Campestrol	Phytosterol[35]
6.	Curcain	Protease[20]
7.	Curcasin	Toxalbumin[7]
8.	Curculathyrane A	Lathyrane diterpenoid[32,33]
9.	Curculathyrane B	Lathyrane diterpenoid[32,33]
10.	Curcusone A	Rhamnofolane diterpinoid[31]
11.	Curcusone B	Rhamnofolane diterpinoid[31]
12.	Curcusone C	Rhamnofolane diterpinoid[31]
13.	Curcusone D	Rhamnofolane diterpinoid[31]
14.	Daucosterol	Terpinoid[35]
15.	Jatrocurin	Triterpenes[39]
16.	Jatropha curcus flavonoid I	Flavonoid[28]
17.	Jatropha curcus flavonoid II	Flavonoid[28]
18.	Jatropha curcus triterpene	Tritepene[28]
19.	Jatropha factor C 1	Diterpene[37]

20.	Jatropha factor C 2	Diterpene[37]
21.	Jatrophine	Alkaloid[31]
22.	Jatrophol	Phytosterol[31]
23.	Jatropholene A	Terpenoid[31]
24.	Jatropholene B	Terpinoid[31]
25.	Jatropholone	Diterpene[31]
26.	Lignoceric acid	tetracosanoic acid[29]
27.	Linoleic acid	Omega-6 fatty acid[36]
28.	Myristic acid	Tetradecanoic acid[29]
29.	Oleic acid	Omega-9 fatty acid[36]
30.	Palmitic acid	hexadecanoic acid[29]
31.	Palmitoleic acid	9-hexadecenoic acid[29]
32.	Scoparone	Phytoalexin[39]
33.	Stearic acid	Acid[36]
34.	Stigmas-5-ene	Terpinoid[35]
35.	Stigmasterol	Phytosterol[28]
36.	Tomentin	Diterpenoid[31]
37.	7- α-diol	Phytosterol[23]

III. BIODIESEL PLANT

Fossil fuels containing hydrocarbons have been the prime source of energy for the transportation sector for ages. However their rapidly increasing consumption and consequent depletion of reserves clearly show that the ends of the Fossil fuel Age is not far. Besides there fuels are the chief contributors to urban air pollution and major sources of Green house Gases. Global demands for oil are currently rising at more than 2% a year. Since 1985, energy use is up by about 30% in Latin America, 40% in Africa, 50% in Asia. China's total energy consumption, according to the official data, increased sharply during 2003–2007. [11] Energy demand worldwide is expected to rise by about 50% to 60%over the next 20 years Jatropha has long been known as a green gold. Since Biodiesel can be operated in almost all diesel engines, it offers an immediate displacement of petroleum.

From every 100 lbs of oil and 10 lbs of methanol, the process produces 100 lbs of Biodiesel and 10 lbs of glycerol. Biodiesel is an alternate renewable energy source made from biological sources, like vegetable oils and animal fats. Jatropha has been one of the major non edible oil used for the production of Biodiesel which can be used in its neat form (100%biodiesel) or in a blend with petroleum diesel. The most common blend is B20 that is 20% Biodiesel and 80% petroleum diesel. Biodiesel is biodegradable and non-toxic, and does not contribute to global warming.[12] Petroleum diesel, a fossil fuel, releases carbon into the biosphere that has not been there for millions of years, which, along with the burning of other fossil fuels, has raised the level of “greenhouse gases” in the atmosphere significantly.[13] Since the carbon involved in Biodiesel is from a biological source, it is already a part of the earth’s carbon cycle, and therefore, does not contribute to this greenhouse effect.

IV. ANTICANCEROUS PROPERTIES

Curcin has an obvious antitumor effect and its mechanisms are related to the N-glycosidase activity.[14] More recently, a protein, curcin has been isolated from the seeds of Jatropha curcas that has been used as a cell-killing agent against NCL-H446, SGC-7901 and S180 cells at very low concentration. [15] The genus name Jatropha derives from Greek words “jatros” (Doctor) and “trophe” (food) which implies medicinal was. The latex of Jatropha contains an alkaloid known as “Jatrophine” which is believed to have medicinal properties. [2] The latex of Jatropha curcas is known for anticancerous properties .It also serves as a disinfectant. Four compounds, such as, jatrophine, jatropham, jatrophone and curcain have been reported from the latex of various species of Jatropha.[16] Jatrophine and Jatropham have been demonstrated as anti-cancer.The leaf extract from Jatropha curcas has been used for treating solid tumours.[17] A toxin (curcin) from these leaves has been shown to have an antitumor property.[9, 14] Curcusone B, a diterpene isolated from this plant has been demonstrated to show anti-metastatic properties against the human cancer cell lines. The anti-metastatic properties were studied in terms of reduction in vitro invasion, motility and secretion of matrix-metalloproteinases (MMP). Interestingly, the anti-metastatic concentration of this drug showed negligible toxic effects on the normal cells. [9]

V. OTHER MEDICINAL USES

The latex is applied topically to get relief from bee and wasp stings. [19] In Cuba and various other parts of the world the latex is used against toothache, burns, hemorrhoids, ringworm and ulcers. [7] The latex of the plant has been shown to have haemostatic property. [18] Nath and Dutta (1992) [20] demonstrated the wound healing properties of curcain, a proteolytic enzyme, isolated from latex, on mouse models. Curcain, isolated from the latex of Jatropha curcas was used to prepare two ointments by incorporating 0.5% and 1.0% (w/w) of curcain powder into the washable ointment base. Healing of the wound by the curcain ointments was found to be better than nitrofurazone ointment and propamidine isothionate cream in mice. The latex also has an antimicrobial property against Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Streptococcus pyogenes and Candida albicans. [21] The external application of the J. curcas oil is useful against various skin diseases and rheumatism. [22] It has been reported to be arborificient, and laxative.

Efficacy of oil has also been shown against dropsy, sciatica, paralysis and sores in animals. Some people drink the leaf decoction to cure venereal diseases and heartburn.

Leaves are also used as antiparasitic and, therefore, applied to cure scabies. Some leaves are used as rubefacient while others are used as anti-paralytic and anti-rheumatic. The twig sap of Jatropha is also used to dress wounds and ulcers. An emulsion of the sap with benzyl benzoate is known to be effective against scabies, wet eczema and dermatitis. The roots are known to have strong anthelmintic action .The aqueous extract of the root is used as an anti-dote for snake bites. [16] Some people use root decoction against dysentery [23] and as a mouth wash to take care of the bleeding gums and teeth.[24] These preparations are also used against eczema, ringworm and scabies.[7,18] The sap flowing from the stem is used to arrest bleeding of wounds. Extracts from the roots and stem of Jatropha have been demonstrated to possess pesticidal and insecticidal effects. [25,26,27] It may, therefore, be used as a preventive medicine against the insect and pest-vectors of human diseases. The organic extracts from the roots of J. curcas have been shown recently as antimicrobial, particularly against the sexually transmitted diseases. The purified fractions of these extracts are effective even at concentrations as low as 0.75 g/ml. [28]

VI. OTHER USES OF JATROPHA PLANT

As Jatropha is shrub (or small tree) it is spaced widely in fields when grown as field crop. In order to utilize the space between two shrubs, it is been tested with many herbal crops and found Ashwaganda (*Withania somnifera*) best among these. In presence of Ashwaganda Jatropha crop showed no negative responses whereas presence of Jatropha crop helped in repelling away the harmful insects from Ashwaganda crop. In nearby vegetable fields under severe attack of harmful and pesticide resistant insect, people use aqueous extracts and leachate of different plant parts as repellent successful. The Jatropha leaves provide plentiful organic manure. The tender branches and the leaves are widely used to prepare manure. The tree releases the oxygen into the environment and accumulates carbon dioxide in the plants. On in corporation, it enriches soil carbon. The plants reduce soil erosion and will help to conserve moisture. The Jatropha plant has been grown in various gardens in India for their ornamental foliage and flowers. In central parts of India farmers have been using Jatropha as fence crop. Besides protection from entry of cattle and animals during hot summer when temperature goes up to 40-47 ^{o}C, these plants act as barrier against hot winds and play vital role in reducing the evapotranspiration rates.

VII. CONCLUSION AND FUTURE PROSPECTS

Today we live in a synthetic world where everything is made up of synthetic chemicals from tip to toe. A wave of ‘herbalization’ is now on, aiming to reach our roots, our origin. The valuable medicinal information, in ancient times, used to be passed on from generation to generation largely through the traditional practices. Efforts need to be made to explore and develop this treasure of knowledge power of our ancestors. Jatropha curcas (Ratanjyot) has been famous the world over because of its significance as a renewable source of bioenergy .Besides its toxicity its importance as a medicine for diseases like cancer, arthritis, scabies etc is also now known. In view of the immense potentiality of this plant as a good resource for several therapeutic products it is recommended to produce genetically engineered Jatropha plant that possesses energy and pharmaceutical values without or with permissible toxicity. Concerted efforts must be also done further exploration of its properties and usage so that this “Green Gold” can be a “resurrecting “plant for our planet.

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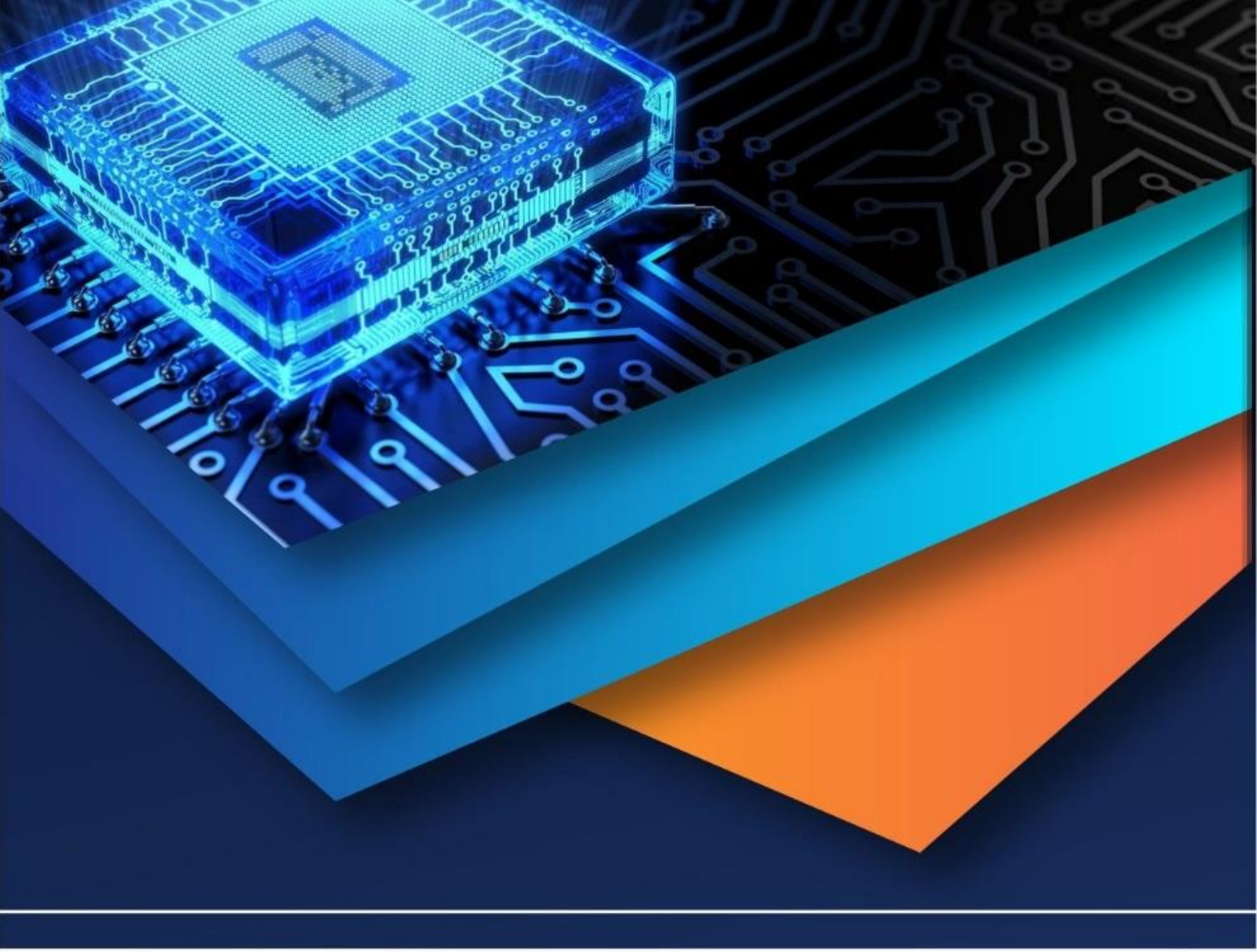

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