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DANDELION-AN ALTERNATIVE TO RUBBER

Kalyani A. Motghare[1], Vaishnavi Kasawar[2], Rasika Bhumbur[3]

[1]*Assistant Professor, Chemical Engineering Department, Jawaharlal Darda Institute of Engineering and Technology, Maharashtra, India,* ***kalyanimotghare@yahoo***

[2]*Student, Chemical Engineering Department, Jawaharlal Darda Institute of Engineering and Technology, Maharashtra, India,* ***vaishnavikasawar24@gmail.com***

[3]*Student, Chemical Engineering Department, Jawaharlal Darda Institute of Engineering and Technology, Maharashtra, India,****rasikabhumbur225@gmail.com***

Abstract

Natural rubber is a biopolymer found in tree sap of rubber trees. Natural latex acts as a barrier to micro-organisms and is helpful for sealing wounds. Russian dandelion (Taraxacumkok-saghyz) is an efficient replacement for Natural rubber tree. The plant is able to grow in moderate climate. A white milky fluid exudes when the flower stem is broken, known as Latex which consist of laticifers. Dandelion was used by humans for food and as an herb. It also possess medicinal value. It can also withstand difficult environmental conditions. Our present study emphasizes the extraction of rubber from Dandelion species which serves as an efficient alternative to the commonly used plant for rubber extraction, Heveabrasiliensis.

Keywords*: Dandelion, Taraxacumkok-Saghyz, Latex, Heveabrasiliensis*

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1. INTRODUCTION

Rubber was firstly used by people of Amazon basin in South America. It was obtained from the tree Heveabrasiliensis. The latex material is secreted by the tree whenever it is cut as a part of natural healing process. [4] Dandelions were evolved about 30 million years ago in Eurasia.[6] It was discovered in Kazaksthan during the World Wars.[1][3] It was used by humans for food and as an herb. They also possess medicinal value.[6]

Natural rubber is a biopolymer found in tree sap of rubber trees. It is primarily used to make tires. Smaller portion of worldwide production of rubber is used to make gloves, adhesives, gaskets, hoses, rubber balls and many other products.[2] Its foremost properties includes resistance to abrasion and impact, elasticity, and heat and cold tolerance.[3] Melting point of Rubber is 180deg.C.[5] Latex is coagulated when exposed to air and consist of polymer emulsion and metabolites which are often toxic.[2] The ammonia solution is used to prevent the coagulation of raw latex.[5] Natural latex acts as a barrier to micro-organisms and is helpful for sealing wounds. The property of Crystallisation of Natural rubber under strain separates it from Synthetic rubber.[2] Synthetic rubber is a non-renewable source, rubber based and comparatively more expensive.[3] In India, Kerala constitutes almost 90% of Natural rubber production.[8]

Russian dandelion (Taraxacumkok-saghyz) is an efficient replacement for Natural rubber tree. The plant is able to grow in moderate climate and even on land, which is not suited for cultivation of crops. It can also withstand difficult environmental conditions.[2] The flower heads are yellow or orange-coloured and are open during daytime but closed at night. The leaves are generally 5-25cm longer, simple or lobed.[7]

When the flower stem of a dandelion is broken, a white milky fluid exudes which is known as Latex. Latex is made up of laticifer which includes proteins, carbohydrates, oils, gums and resins. [2]

Fig 1: Russian Dandelion[3]

The species of dandelion were extensively cultivated in USSR covering almost 30% of the total USSR rubber consumption. Due to the shortages of Natural rubber during World War 2, many countries opted for cultivating dandelion as an alternative. Cultivation was expensive and labour-intensive. After World War 2, the Natural rubber was available again and cultivation of dandelion was terminated due to economic reasons. [1]

Table-1: Sources and Properties of Natural rubber producing plants[1]

Natural rubber producing plants	Property	Source of rubber	Production (Tonnes per year)	Content of rubber
Heveabrasiliensis	White or yellow latex occurs in latex vessels in the bark	Bark	9,000,000	30-40
Russian dandelion	Milky fluid in its roots	Root	3000	0-15

2. EXTRACTION PROCESS

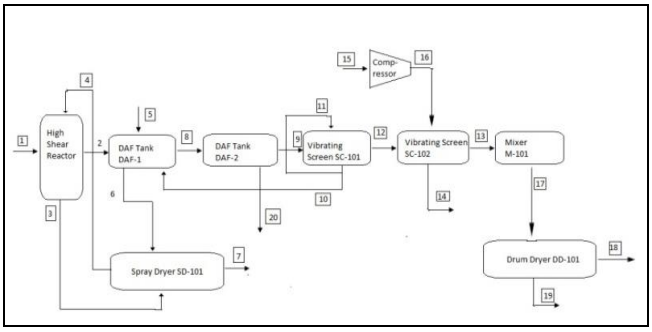

Fig.2: Process Flow Diagram for Rubber Extraction From Dandelion[2]

Dried roots of dandelion obtained after farming are fed to Cone crusher and then allowed to grind. The sizes of the roots are reduced from 15-20cm to 25mm. The roots are then again ground in rod mill which again reduces the size to 2.5mm suitable for extraction process. The reduced roots are then fed to reactor in which water at 70deg.c is allowed to enter in it. The Inulin present in roots gets dissolved in the water with the balance of temperature and pH. The Inulin then send to the Spray dryer for further processing. The remaining components of roots are then allowed to enter in Dissolved Air Floatation tank (DAF). The process of Extraction and Coagulation takes place in two series of DAF tanks. The residence time of both the tanks is assumed to be 20 minutes. 0.02gm of cellulose enzyme per gram of cellulose present in roots is added to the first DAF tank. The interaction between cellulose enzyme and cellulose helps in loosening of cellulose components of the roots from the rubber which results in the formation of glucose as a byproduct.

On the basis of literature in accordance with loading, temperature and residence time, 10% of cellulose is converted into glucose. It is assumed that the remaining Inulin in the process stream is dissolved in the first DAF tank. The Glucose and Inulin streams are then allowed to enter in the same Spray dryer as an Inulin stream from the reactor for further processing. The remaining process stream consisting of natural rubber, water and cellulose is then send to second DAF tank for coagulation of Rubber. The Natural rubber is obtained from the top of the DAF tank and the remaining are then for drying process. After passing through the second DAF tank, cellulose is entirely removed from the mixture of water, Cellulose and Natural rubber. The moisture is then allowed to pass through the vibrating screens for the removal of water and to obtain a clean product. The rubber is then send to Mixer followed by Drum dryer for reduction of water content by 10%. The rubber is then ready to be baled, packaged and sold as a final product. [2]

3. MEDICINAL APPLICATIONS OF DANDELION

- Dandelion has been traditionally used for gall bladder and urinary disorders, Jaundice, gallstones and edema associated with high blood pressure and heart disease, skin complaints and chronic joints.
- Source of vitamin A, vitamin C, potassium, calcium, iron, magnesium and phosphorus.
- Usage of this herb increases bile production by the liver and urinary output from the kidneys.
- Powerful remedy for hypertension, water retention and cardiac oedema which is caused due to congestion in the blood vessels.[9]

4. CONCLUSION

As per the study conducted, Dandelion can be used as an effective alternative for Natural rubber, if both economical and environmental aspects are concerned. The rubber content of Dandelion is not in fair amount but still it contains some amount of Insulin, a polysaccharide which can be used as a raw material for Biofuel or Ethanol production.

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