Tannic Acid Production

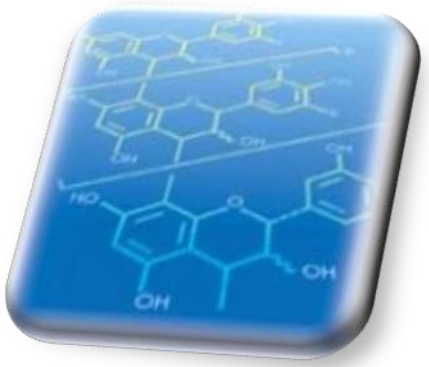
Ensymm abstract for solvent-free production of Tannic Acid from fruit peels and organic waste

ensymm
Project Consulting
for Life Science

INTRODUCTION- WHAT IS TANNIC ACID?

Tannic acid (also known as gallotannic acid, gallotannin, digallic acid or glycerite) is a plant polyphenol which is contained in roots, husks, galls and leaves of plants. Tannic acid belongs to the category of tannins. It has an astringent property: this can be remarked while drinking wine or strong tea as a bitter and dry feeling in the mouth. It has astringent, antibacterial and anti- enzymatic properties. It is used in industrial processes to convert animal skins to leather, what is called “tanning”, and it is also used to clear wines and to produce black tea.

It is used in many more sectors for example in the pharmaceutical industry, as food additive, as rust converter, as a mordant for cellulose fibers and for dyeing.



Sources

The pomegranate (*Punica granatum*) husk is an important source of tannic acid. Most of the pomegranate production is located in the northern hemisphere. Pomegranates grow in climates with hot dry summers and cold winters, dormancy is an important condition for growth.

The advantage especially of pomegranate husks is that they are less toxic than gallnut husks. The husks are by-products of the pomegranate juice production, so it is an efficient waste management, mentioned as a positive side- effect. Other sources of gallic acid are galls from oak, oak-apple and pistachio trees. Galls are special plant parts; they were formed by several plants when they are infected by animals, especially by insects. There are different forms of galls: Japanese/ Chinese galls, British/ American galls and Aleppo galls. Tannic acid is also found in the bark of trees (oak, walnut, pine, mahogany), in nettles, in berries and horse chestnuts.

APPLICATIONS

- For “tanning”, a process to convert skin to leather
- Due to its astringent, antibacterial, anti- viral and anti- enzymatic functions, it is employed as an ingredient for antibiotics, guitinea, drugs, detoxicants and antidysenterics and a symerist for synthetic sulphanilamide. Also as disinfectant cleansers
- Employed to clarify wine, tannic acids bind proteins in the wine and build complexes which can be filtered out
- As a food additive
- Widely used in manufacture of "Iron ink", metal corrosion resistance, slime treatment of petroleum drilling and raw material of pharmaceutical industry
- Paper and ink production
- Dyeing processes
- As a mordant
- Since the astringency of tannic acid involves the precipitation of protein, the addition of protein (such as milk or cream) to a tannin- rich tea would “bind” the tannin, rendering it biologically inert
- Used in the oil industry

Biochemistry and Chemical Data

Tannic acid belongs to the group of tannins. It is not a strong acid, but it is named “acid” to distinguish tannic acid from the other tannins.

It is a polymer which consists of gallic acid molecules and glucose.

Tannic acid can react with proteins and then it is able to build insoluble complexes, so one can explain the astringent property while drinking wine: tannic acid builds complexes with the proteins. The molecular formula is $C_{76}H_{52}O_{46}$, it is a yellow to light-brown powder and tastes astringent.

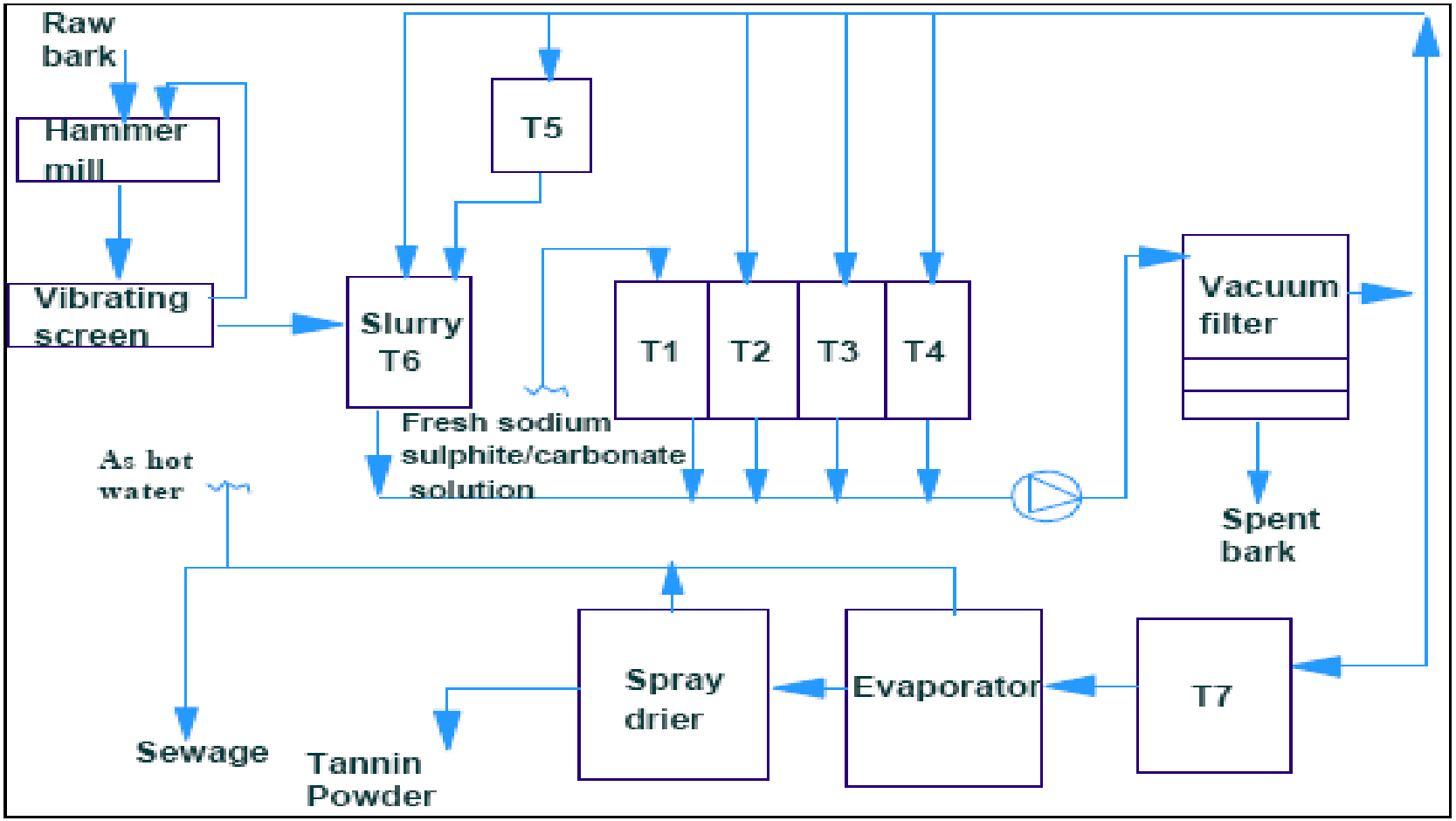
Tannic acid is soluble in water (1g dissolves in 35ml H_2O), ethanol, acetone and warm glycerin; and it is not soluble in ether and chloroform. The molecular weight of tannic acid is 1701.18. Tannic acid is stable, and incompatible with metallic salts, strong oxidant substances and heavy metals.

PROCESSING

At first the process begins with the peel preparation and then extraction. The extraction is solvent-free and water based, it is an innovation process.
The extracted product goes through a four- stage countercurrent-washing before the separation and evaporation of the product solution starts. Then the spray dryer produces tannic acid powder.
The tanning process is shown in the following chart at the example of pine bark extraction. At first the tannic acid containing particles have to be cut up. Subsequently, the particles are transported to a vibrating screen to get a size ranging from 1 to 4mm in diameter. These particles are transferred to a tank (slurry T6), in which a mush is produced with the help of a filtration system. This tank acts as a double tank: one tank has the function for filling or emptying and the second is needed to do the extraction operation.
From this tank the slurry is transferred to a vacuum pump in which it is separated to get the final solution. From the vacuum pump there are three ways in which the solution flows: one part is transferred to tank 5 for recirculation (to be then transported in tank 6), the second part is transported to tank 7 and then to the evaporator from where it flows after evaporation process to the spray drier to produce the final tannic acid powder, the third way starting from the vacuum filter ends at the spent bark.

As observable in the chart, tanks 1-4 have the function to wash the spent bark in order to become more concentrated. In the first tank (T1) fresh sodium sulphite/carbonate solution flows in and washes the spent bark, then flows through the vacuum filter to be at the next step transferred to tank 2. This circulation system works until tank 4, where the solution is highly concentrated and will be transferred to tank 5 after passing the vacuum filter to flow to tank 6 for the extraction process, as described.

PROCESSING


Raw bark
Hammer mill
Vibrating screen
T5
Slurry T6
T1
T2
T3
T4
Vacuum filter
Fresh sodium sulphite/carbonate solution
As hot water
Spent bark
Spray drier
Evaporator
T7
Sewage
Tannin Powder

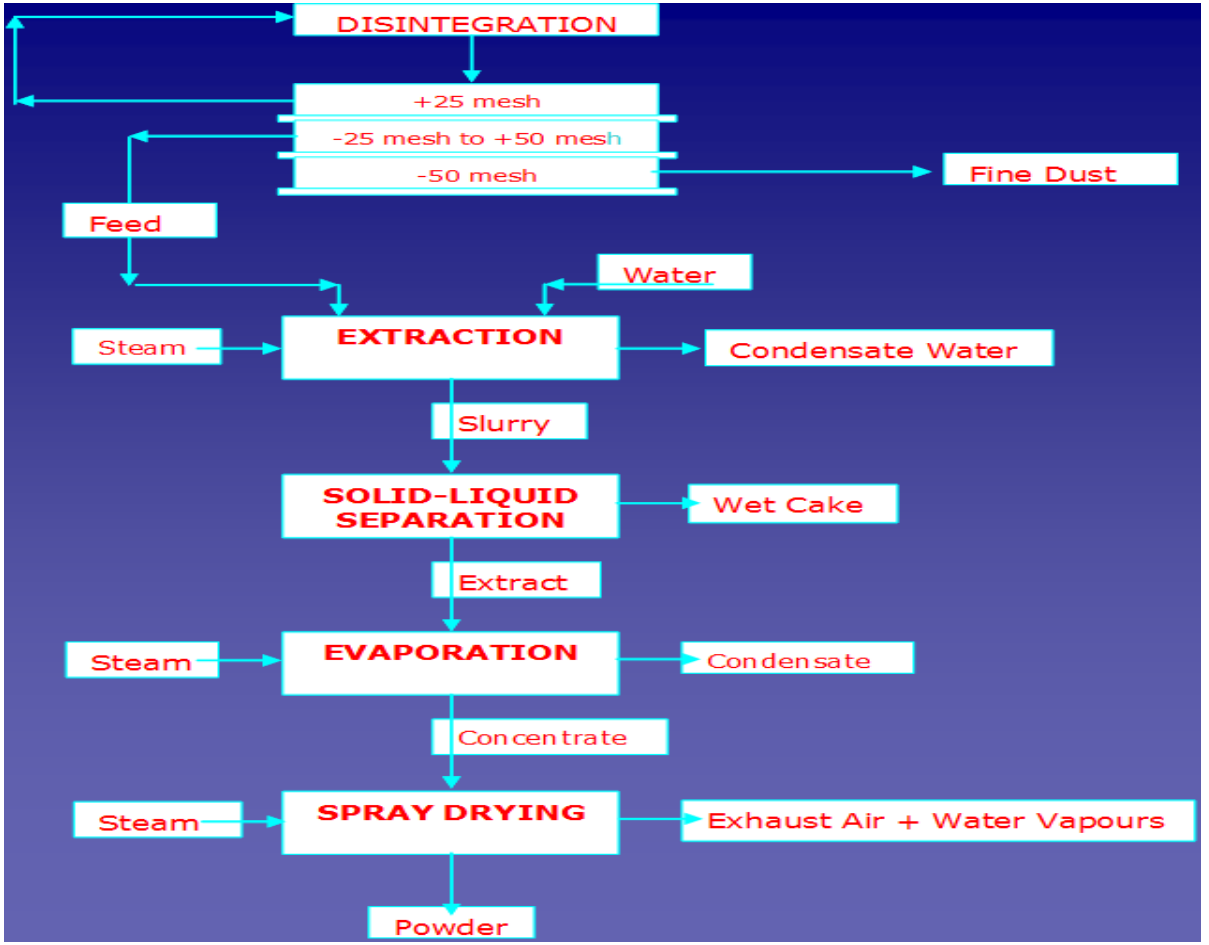
PROCESSING

Ensymm has already finished the pomegranate extraction installations in India and Iran, and one in Kenia is planned.

The facilities which were planned by ensymm company reached up to 60% purity of tannic acid in the powder product. From the amount of 1 t of raw material, it is expected the extraction of about 10- 15% in powder with a content purity of 45-60 % of tannic acid.

The Benefits of the Technology

- High profit
- Environment-friendly
- State of art technology
- Easy operation
- Little quantity of side ingredients are needed; profit from waste (use of food waste).



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