RAMA UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY

# Production of Xanthan gum

•**Xanthan gum** is a microbial polysaccharide of great commercial significance. The producing organism is *Xanthomonas campestris*.

•Xanthan gum consists of chains of cellulose monosaccharides and oligosaccharides. It is an anionic biopolymer. Since 1969, xanthan gum is approved by the FDA as a food ingredient.

•The production of xanthan gum is an aerobic fermentation process starts with the bacterial strain of *Xanthomonas Campestris*.

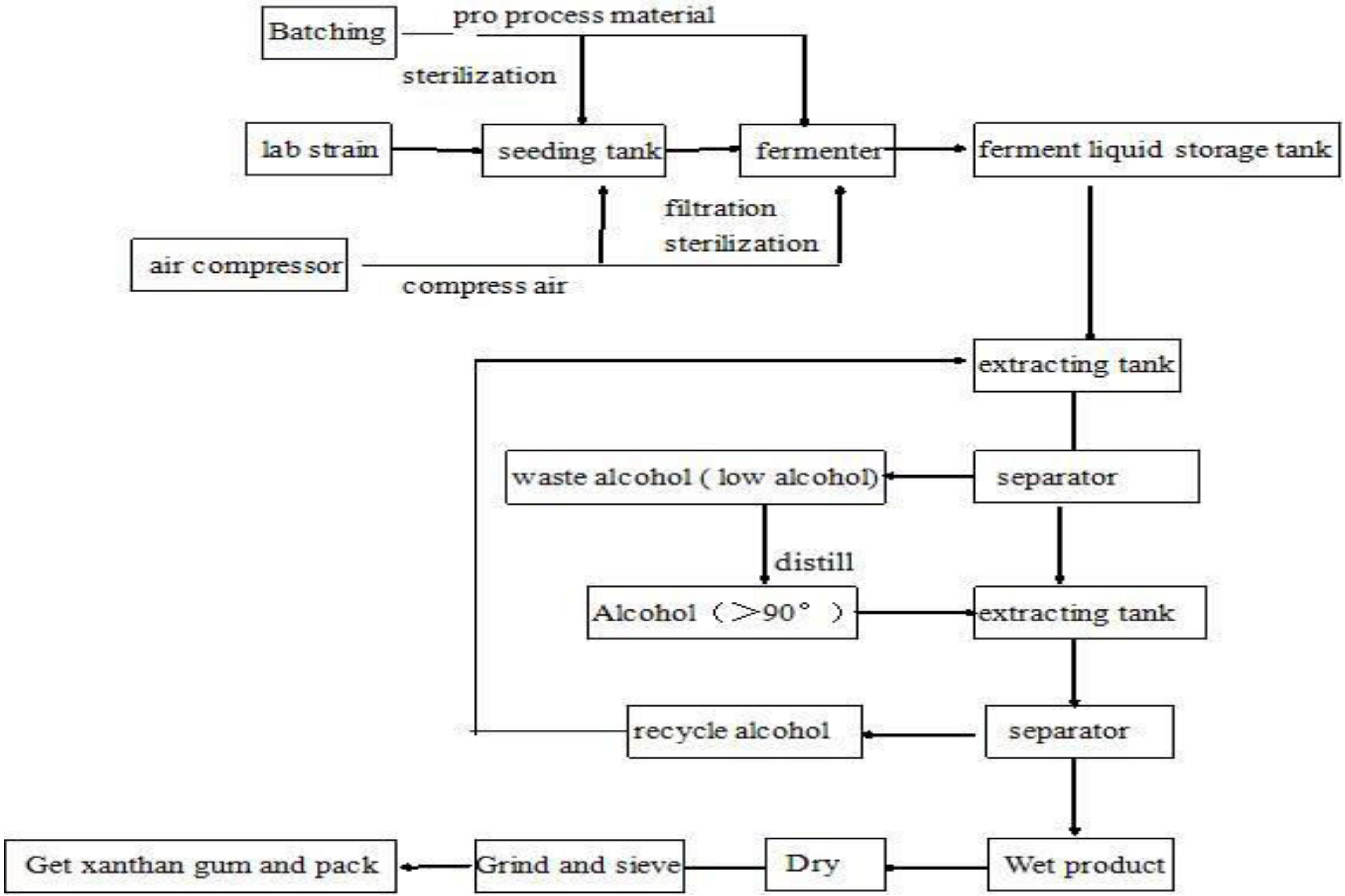
•The common substrates based on sugars. The production process involves a multistep inoculation preparation followed by fermentation, pasteurization, precipitation by an alcohol, drying, milling and packaging.

•After fermentation, the fermentation broth contains 2–3% xanthan gum. In the conventional process, alcohol precipitation is used to recover the xanthan gum from the fermentation broth. An alternative approach is to use ultra filtration for the concentration and purification of the xanthan gum.

The key properties of xanthan gum are its extreme pseudoplasticity and its very good thermal and pH stability.

The industrial applications of xanthan gum range from the food industry (as, e.g., stabilizer, emulsifier, swelling, and thickening agent) over the pharmaceutical and cosmetic industry (as, e.g., emulsifier and binding agent) to the petroleum and oil industry (as, e.g., drilling liquid to maximize oil recovery).

The flow characteristic of xanthan, along with its stability to salts and high pH, gives it a technical advantage over most polymers used in drilling.


Batching
pro process material
sterilization
lab strain
seeding tank
fermenter
ferment liquid storage tank
filtration
sterilization
air compressor
compress air
extracting tank
waste alcohol ( low alcohol)
separator
distill
Alcohol（>90° ）
extracting tank
recycle alcohol
separator
Get xanthan gum and pack
Grind and sieve
Dry
Wet product

- Nisin is a polycyclic antibacterial peptide produced the bacterium *Lactococcus lactis*.
- It is used as a food preservative.

- It has 34 amino acid residues, including the rare amino acids lanthionine (Lan), methyllanthionine (MeLan), didehydroalanine (Dha), and didehydroaminobutyric acid (Dhb).

- Two natural nisin molecules exist, termed nisin A and nisin Z.

- Nisin Z has a similar antimicrobial activity to nisin A.

- Nisin inhibits the outgrowth of spores and kills cells in the vegetative state.

- The primary target of nisin in vegetative cells is the cytoplasmic membrane
.
- It is more effective against Gram +ive and lea against Gram –ive, fungi and virus.

•**Production and purification**

•Nisin production is affected by many factors such as the producer species, composition of the culture medium, pH, temperature, agitation, aeration, adsorption of nisin by the producing cells, and enzymatic degradation.

•The release of nisin from the cells to the medium is pH dependent. At pH lower than 6, more than 80% of the produced nisin is extracellularly released.

•At pH higher than 6, most of nisin produced is associated to the cell membrane or intracellularly.

•Nisin are also highly sensitive to the action of proteolytic enzymes.

•At laboratory scale, commercial culture media is used, such as MRS and M17 broth, but their high cost makes them impractical for large-scale production. In addition, the culture medium usually contains excess of protein (tryptone, peptone, meat extract, and yeast extract).

- Industrial wastes have aroused the interest to be used as raw material for nisin production. Whey, a milk byproduct of dairy industry, has been used in some researches for the production of nisin.

- Greater production of nisin can be achieved by genetically modified strains.

- Moreover, these techniques could improve antimicrobial activity of nisin or its stability at elevated temperature and/or under neutral or alkaline conditions.

- The fermented product is subsequently concentrated, separated, processed by spray dryer technique, and turned into small particles.

- The final product consists of 2.5% of nisin contained in NaCl and denatured milk solids. Specific purification protocols were designed for nisin purification depending on its final usage (e.g., food, drug, cosmetics).

- Nisin has been purified using expanded bed ion exchange chromatography, immune-affinity chromatography, ion exchange chromatography, hydrophobic interaction chromatography, gel filtration, and reversed-phase highpressure liquid chromatography.

•Nisin is extracted using organic solvents, such as ethanol and methanol, or ammonium sulfate precipitation and acid precipitation (pH 2.0). Nisin is highly active in acid pH but lose activity above pH 7.

**Nisin application**

•Nisin is applied as natural preservative in food, such as cheese, butter, canned, alcoholic drinks, sausages, pasteurized liquid egg, and salad dressings, among others, alone or in combination with other conservation methods. Other applications in preservation technologies include the development of antimicrobial active packaging, liposomes, and nanodelivery systems.

•Although the main application of nisin is in foods, particularly dairy products, research have found its potential for therapeutic purposes, such as treatment of atopic dermatitis, stomach ulcers, and colon intestinal infections for patients with immunodeficiency. Researchers have shown the effectiveness of the antimicrobial activity of nisin in control of respiratory tract infections caused by *S. aureus* in an animal model.