



Technology Match Maker | Sustainable Ingredients for Functional Foods & Additives | Oct 2023

Exopolysaccharides For Probiotic Fortification And Food Processing



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Exopolysaccharides (EPS)

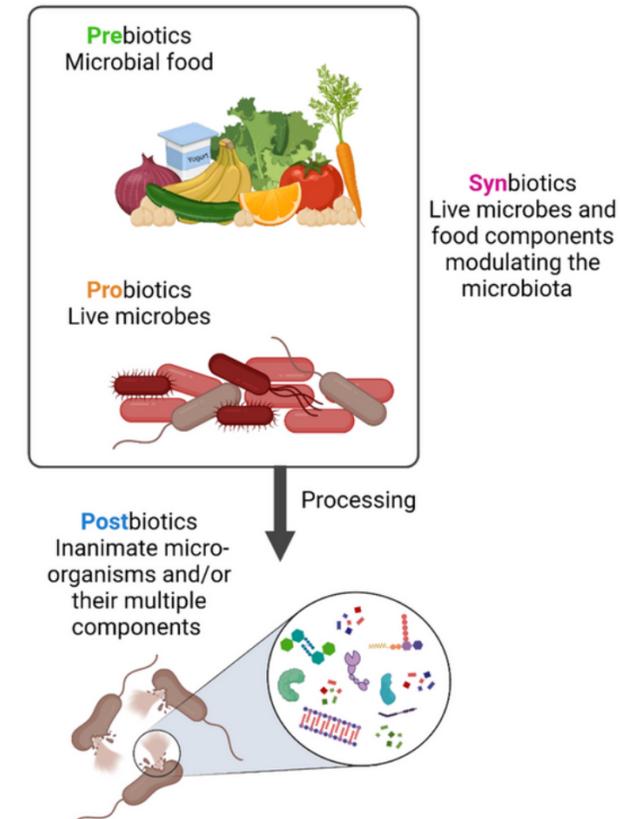
- EPS are extracellular macromolecules produced by food grade bacteria.
 - Used as source of polysaccharides.

- Industrial applications:

- Food industry as additive to enhance flavour & texture; prevent syneresis; improve viscosity, sensory appeal and shelf life of food products.
- Cosmetics industry as rheology modifier and facial masks.
- Pharma as API, excipient for stability and targeted drug delivery.
- Food packaging industry for biodegradable thin films.

- EPS from Lactic Acid Bacteria (LAB) with USFDA GRAS status:

- Processing of raw foods, industrial fermentation, developing prebiotic and postbiotic ingredients.



Market Opportunity

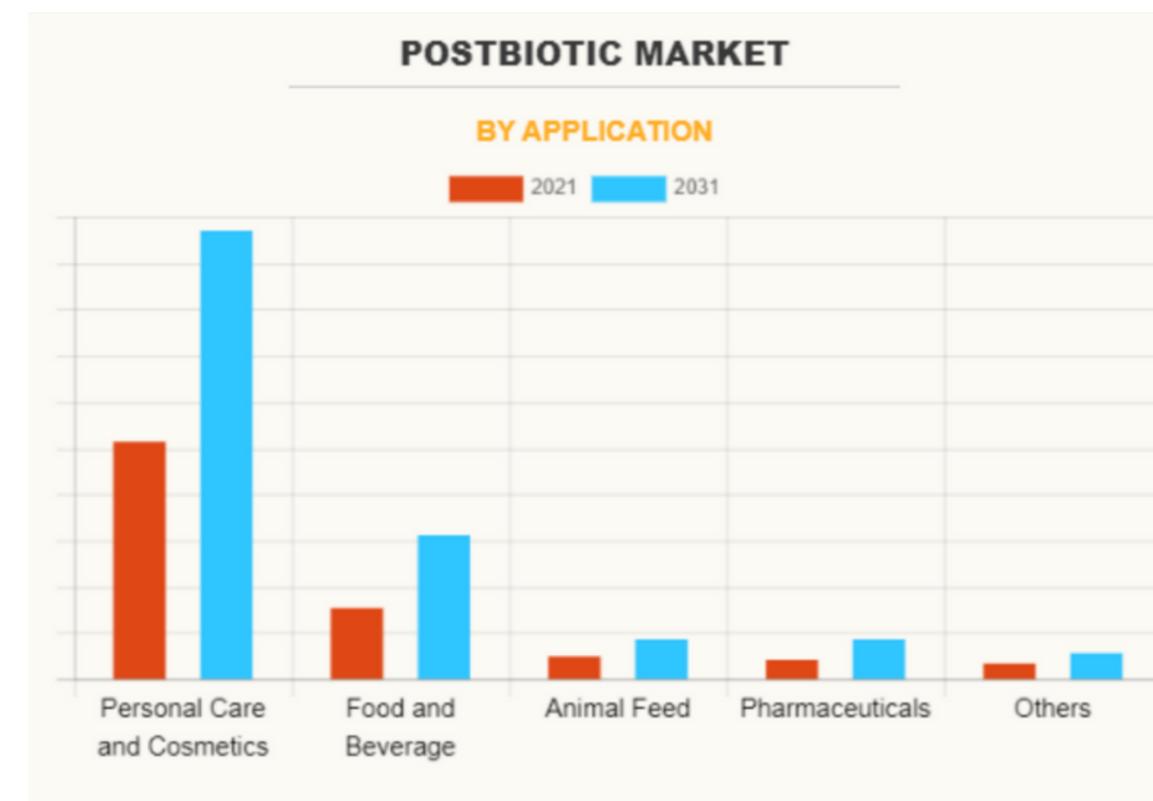
The global polysaccharides market was valued at USD 14.04B in 2021 and is expected to reach USD 21.41B in 2030 growing at a CAGR of 4.8% during the forecast period.

Key Market Drivers are:

- Growing demand for naturally produced polysaccharides.
- Newer manufacturing techniques.
- Rising awareness for clean label products with unadulterated and organic ingredients.
- Increasing use in animal feed for nutritional benefits.

Market leaders: DuPont, Cargil, Tate & Lyle, Dow Chemical, Koninklijke DSM, BASF, Novozymes etc.

Challenges: Optimising cost and increasing yield of production.



Global market for postbiotics is expected to grow at CAGR 6.8% reaching a value of USD 3B in 2031 from a value of USD 1.6B in 2021.

- Based on uses, market demand from:
 - Personal care & cosmetics
 - Food & Beverages

Who Should Be Interested?

Who?	Why?
Functional foods companies with focus on health and nutrition	<ul style="list-style-type: none">• Novel postbiotic products• Products with increased stability and shelf-life
Manufacturers of food ingredients, dairy products and frozen foods like yogurts, ice creams	<ul style="list-style-type: none">• Novel products with enhanced nutritional benefits• Products with increased stability and shelf-life
Cosmeceutical companies	<ul style="list-style-type: none">• Novel products from natural source• Products with increased stability and shelf-life.
Pharmaceutical companies	<ul style="list-style-type: none">• Novel products from natural source• Products with increased stability and shelf-life.

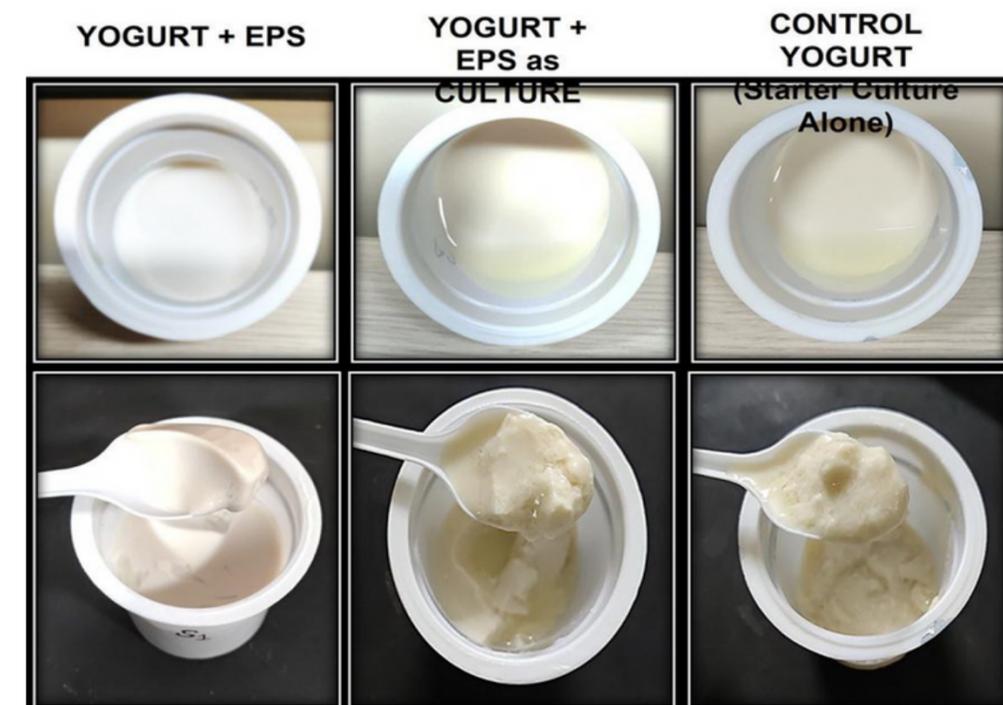
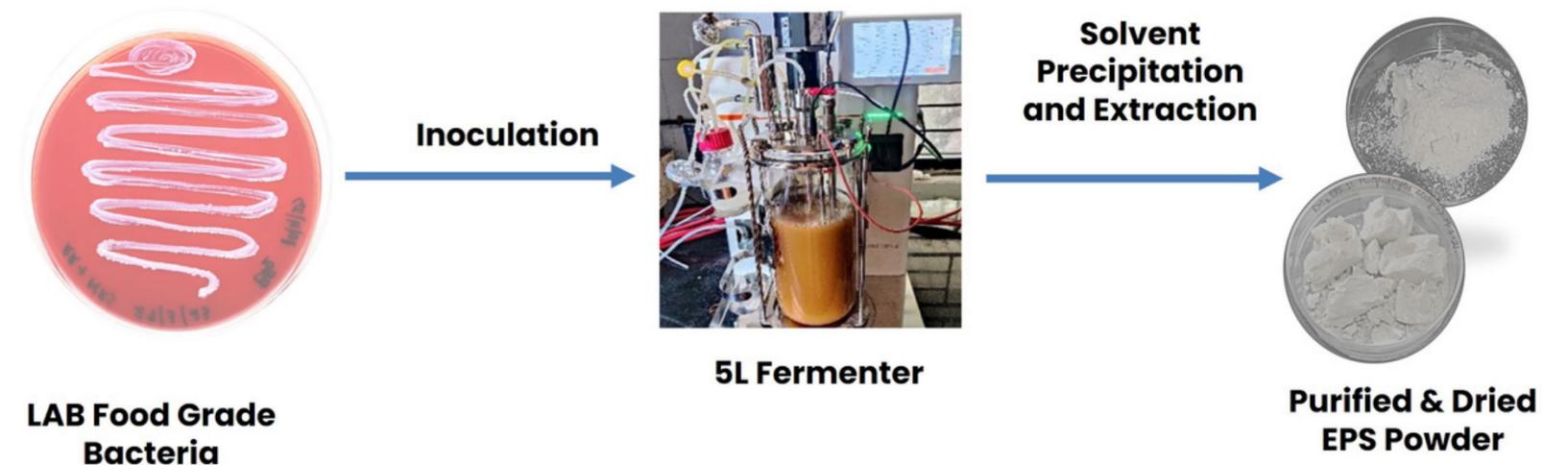
About the Technology

Process features:

- **Microbial synthesis of Exopolysaccharides (EPS):**
 - **Using Food grade bacteria** - both wild-type as well as genetically improved strains
 - **High yield** of EPS using relatively low cost raw materials.
 - **Raw material source optimized** - high starch content such as cassava starch hydrolysate, jackfruit seeds etc.
 - **Ease of extraction:** Product secreted out into the broth.

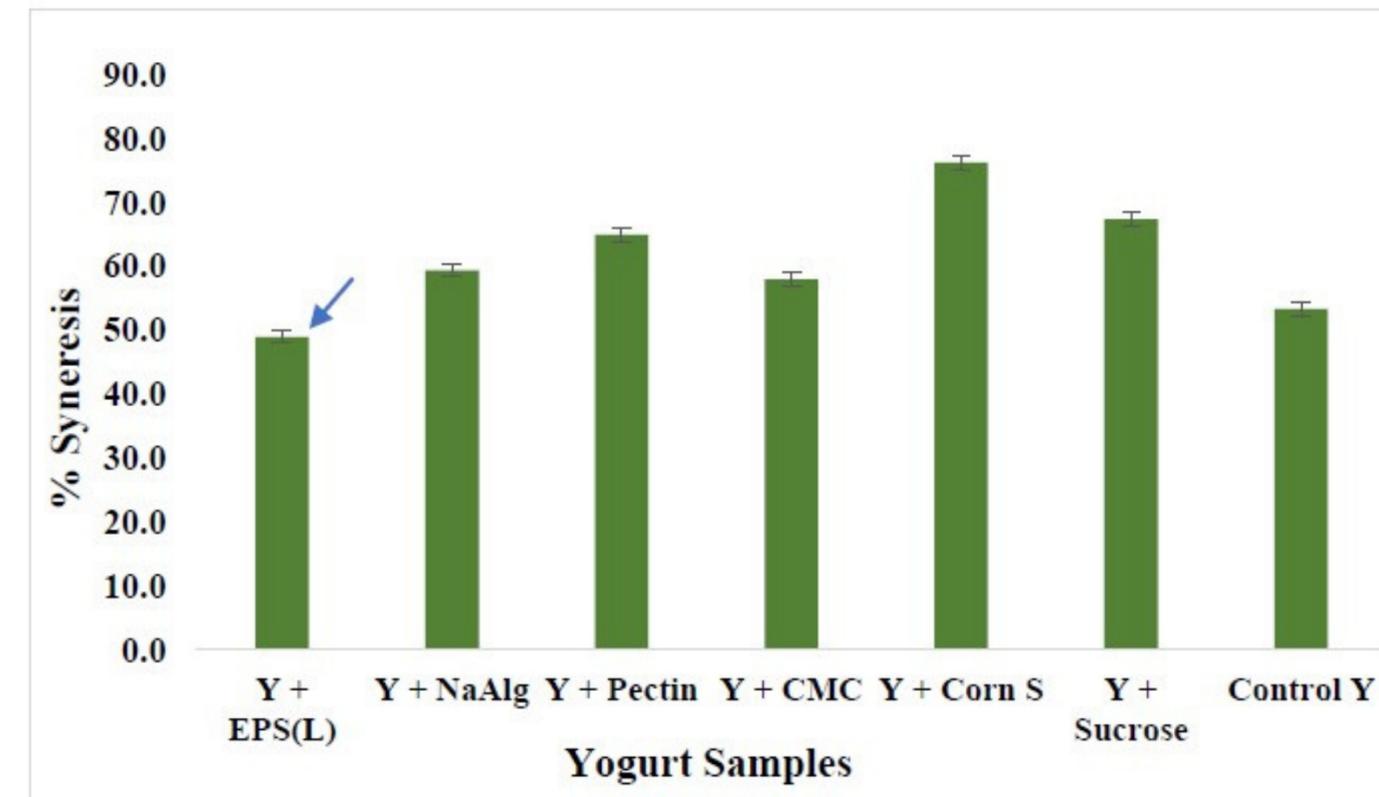
Product features:

- **High quality and powder consistency** - two types of EPS produced:
 - **DEXTRANS EPS** having high molecular weight with good anti-syneresis properties.
 - **Yield:** Highest yield of 19.92 g/L.
 - **GLUCOMANNAN EPS** with potential antioxidant, cholesterol adsorption properties.
 - Anti-tumor activity: In-vitro cell lines studies.



Anti-syneresis Agent ~ A Case Study

- **Activity of Dextran EPS in yogurt from skim milk to prevent syneresis**, i.e., separating out of water layer, was compared with other stabilizing agents such as NaAlg, Pectin, CMC, Corn Starch etc.
 - Dextran EPS at very low concentrations of 0.2% showed significant anti-syneresis activity.
- **Anti-oxidant property** – Yogurt with Dextran EPS also had higher anti-oxidant property than control yogurt tested periodically during 21 days of storage.
 - Using DPPH radical scavenging activity.
- **Sensory and texture evaluation** – Yogurt with EPS gave better mouthfeel, texture, colour as well as creaminess to the yogurts.



Current Status

Technology Status:

- Demonstrated at lab-scale 5L fermenter capacity.

IP Status: Patent Application filing in progress.

Publications:

- M.P. Soumya et al, Nisin controlled homologous Over-expression of an exopolysaccharide biosynthetic glycosyltransferase gene for enhanced EPS production in Lactobacillus plantarum BR2, Bioresource Technology, Vol. 385, 2023, 129387.
- M.P. Soumya, et al., Cassava starch hydrolysate as sustainable carbon source for exopolysaccharide production by Lactobacillus plantarum, Bioresource Technology Reports 6 (2019) 85–88.
- MP Soumya, KM Nampoothiri, Evaluation of improved biological properties of chemically modified exopolysaccharides from Lactobacillus plantarum BR2, Biotech 13 (9), 308.
- Sasikumar et al, An exopolysaccharide (EPS) from a Lactobacillus plantarum BR2 with potential benefits for making functional foods, Bioresource Technology, Vol. 241, 2017, Pages 1152–1156.
- Dilna et al, Characterization of an exopolysaccharide with potential health-benefit properties from a probiotic Lactobacillus plantarum RJF4, LWT - Food Science and Technology, Vol. 64, Issue 2, 2015, Pages 1179–1186.



Lead Scientist:

Dr Madhavan Nampoothiri

- **Chief Scientist and Head** of the Microbial processes and Technology division of CSIR -NIIST, Thiruvananthapuram.
- **Professor** of Biological Sciences, AcSIR at CSIR-NIIST, Trivandrum.
- **Expertise:** Industrial enzymes, microbial metabolites, genomics and infectious diseases, probiotics and nutraceuticals.

CSIR- National Institute for Interdisciplinary Science and Technology (NIIST) is a constituent laboratory of CSIR, India, engaged in research and development activities in the field of Agro-processing & technology, Chemical Sciences & technology, Materials Science & Technology, Microbial processes & technology, Environmental Technology etc.

Key assets and strengths of the team:

- 7 total patents filed, 6 granted US patents, 1 granted in India; Nearly 200 publications, 140 research communications and 45 NCBI gene sequence submissions.
- **Team Strength:** 14
- **Well equipped labs and analytical facilities:**
 - Fermenters 2, 5,20,150 L; Pilot plant facility for bioethanol program 2G ethanol biorefinery technology; biomass valorization for fuel and chemicals with daily processing capacity of 80 kg; Koji room for large scale solid state fermentation facility, 50-80 kg biomass holding trays.
 - Analytical systems HPLC , GC, LC MS, Gene sequencer, ultracentrifuge, amino acids analyser, GPC, Flash Chromatography etc.
- **International Collaborations:** Institutes and universities in Germany, France, UK, Mexico and Portugal.
- **Industry projects/ Tech transfer:** Nourish Food, Accelarated Pvt Ltd. – a Branch of Amaglagm foods, Margosa Pvt Ltd, TATA chemicals.

Next Steps

- Team has developed the background science and demonstrated EPS production at lab-scale 5L fermenter.
 - Wild-type as well as genetically improved strains.
- Developing and testing products with beneficial properties, EPS as well as natural cultures, for use in dairy products and yogurts from various plant derived milk.
- The team has expertise to modify and get desired product.
- Next phase will be to work closely with industry partners to:
 - Optimise process and product as per customer requirements.

Seeking:

- **Industrial partners interested in technology licensing.**
- **Industrial partners interested in sponsoring further technology advancement and scale up.**
- **Industrial partners interested in raising 3rd party funds for a collaborative project.**
- **Industry interested in tapping scientist capabilities as an expert/consultant.**

For More Information Contact:

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References

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- Slide 3 - <https://www.alliedmarketresearch.com/postbiotic-market-A31027>