

## **Green Manufacture of Mass Consumption Products: Polymeric Ester Polyglycerol Polyricinoleate as an Example**

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**Topic:** The elements and the Periodic Table for sustainable chemistry

### **Abstract:**

The food additive, named polyglycerol polyricinoleate (PGPR) and identified with the code E-476, is used as emulsifier in tin-greasing emulsions for the baking trade and for the production of low-fat spreads. However, the main use of PGPR is in the chocolate industry, where, besides its action as an emulsifier, it also has important properties as a viscosity modifier and thus improves the moulding properties of the molten chocolate. An additional property of PGPR in chocolate is its ability to limit fat bloom.

Current chemical methods for preparing this emulsifier involve two steps: condensation of the ricinoleic acid to produce polyricinoleic acid, and esterification of polyricinoleic acid with polyglycerol. This procedure requires long reaction times and high operating temperatures, which adversely affect the quality of the final product leading to problems of coloration and odors that could make it inadvisable for the food industry. As an alternative, the enzymatic synthesis of PGPR by the catalytic action of lipase has been developed. Enzymes act in mild reaction conditions of temperature and pressure, neutral pH, and in a solvent-free system, which makes the process environmentally friendly and avoids side reaction, so that the product has a higher purity and quality.



Commercial PGPR



Enzymatic PGPR

Many reported lipase-catalyzed syntheses are carried out in organic solvents. However, residues of organic solvents in products are undesired, and many solvents which could be used are even toxic and are not allowed for processing procedures to make products for food applications. As well as that, removal of organic-solvent traces in products requires extra expense and increases manufacturing costs. Solvent-free processes are thus desired due to their advantages and because they fulfill the twelve principles of the Green Chemistry, as defined by Anastas and Warner.

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