Enzymatic water degumming

Higher oil yields for new and existing plants
First stage of the oil refining process, degumming aims at separating neutral oil triacylglycerols (TAG) and diacylglycerols (DAG) from impurities. Some of those impurities like phospholipids, gums and proteins are soluble in oil in their anhydrous form, but insoluble once they are hydrated.

In conventional degumming process, water is used to remove hydratable phospholipids. The non-hydratable part of the constituents is then removed using an acid treatment.

During this water degumming process, the hydrated phospholipids drag neutral oil with them, resulting in formation of an emulsion containing water, phospholipids and entrained neutral oil. This viscous gum is then separated from bulk oil by centrifugation.

In water degumming, however, the strong emulsifying properties of Phosphatidylcholine (PC), by far the most hydratable phospholipid, can cause losses of oil. Further yield losses can occur during centrifugation because clean separation of oil (light phase) from gum (heavy phase) requires the sacrifice of oil close to the phase boundary.

Residual phospholipids in the water-degummed oil cause additional yield losses in later refining steps, such as removal of free fatty acids, again owing to formation of an emulsion.

Thanks to its partnership with Royal DSM, global science-based company active in health, nutrition and materials, Desmet Ballestra is offering an alternative to conventional water degumming based on the use of enzymes, with outstanding advantages: reduction of oil yield loss, refining costs and undesired by-products and waste.

Purifine® PLC breaks phospholipids (phosphatidylcholine (PC) and phosphatidylethanolamine (PE)) into water-soluble and oil-soluble fragments, reducing their ability to form an emulsion. Less emulsion means less yield loss due to entrained oil, and lower gum content enables cleaner separation of oil and heavy phases, with further reduction in yield loss. Moreover, the diacylglycerols (DAG) produced through the Purifine® PLC degumming process represent a bonus oil yield that is retained throughout the whole refining process.

Phospholipase A (PLA) generates lysophospholipid and a fatty acid, respectively. PLA1 and PLA2 enzymes differ by the position of the fatty acid removed from the phospholipid. Phospholipase C (PLC) has a different mode of action: it removes the water-soluble phosphate ester from the phospholipid, leaving intact diacylglycerol oil.
Global economic environment leads the oil processing industry to search for additional value from existing investments. And it is exactly what enzymatic degumming using Purfine® PLC is providing: with a basic equipment consisting in an ultra-high shear mixer and a reaction tank, the process can easily be integrated into most existing plant designs.

The mixer creates an interface area between oil and water to enable complete reaction of phospholipids with minimal enzyme dosage and minimum reaction time. In fact, the enzyme reacts rapidly with the emulsifiers and break down the emulsion in less than 2 hours.

The enzymatic process can be optimized by controlling oil temperature, water dose, and enzyme dose. As a result, the enzyme is simply allowed to do its work, without having to adjust process parameters according to the quality of the incoming oil.

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