An overview on ultrafiltration in food processing

Abstract

Generally speaking, purification represents the most costly step within food production and biotechnological processes. Membrane-based processes, such as ultrafiltration (pore size from 10 to 1000 Å) are widely used on an industrial scale. Membrane-based processes are aligned to green chemistry concepts, that is, they are environmentally-friendly, do not generate harmful residues, show a low consumption of energy and an easy scale-up, among others. The food industry applies ultrafiltration to a wide range of fields. For instance (i) dairy - milk treatment, production of ice cream, etc. As an alternative to pasteurization of milk, ultrafiltration can be used also as pretreatment of milk for cheese production, in which large molecular weight compounds such as caseins, whey proteins, etc., are in the retentate, whereas low molecular weight compounds such as lactose and peptides are in the permeate. Similarly, low lactose yogurts can be produced (ii) beverage - during the juice clarification using membranes, pulp, pectin and essential oils are retained, whereas the juice itself is permeate. Ultrafiltration is also used in the production of clear beer and wine (concentration) (iii) degumming edible oils - (e.g., crude soybean oil, sunflower seed oil), in which phospholipids are removed (retentate) by ultrafiltration as an equivalent first step of the oil refining process (traditionally, carried out by water or dilute acid that leads to precipitation phospholipids) (iv) fish, poultry and gelatin - ultrafiltration is largely used for wastewater treatment processes, in particular for high protein content residues. Nevertheless, over the past few decades, the recovery of bioactive peptides and proteins from these wastewaters has drawn significant attention, that is, doubly advantageous (waste treatment and recovery of high added-value compounds) (v) drinking water treatment - high quality potable water implies the absence of microorganisms (e.g., Giardia), organic matter (e.g., humic substances), inorganic particles, and others hazardous substances. This water quality can be achieved by ultrafiltration, in which the main limitation is related to long-term flux decline (membrane fouling). Thus, membrane materials and membrane filtration operating

systems, etc., should be better investigated (vi) recovery of specific molecules - plant proteins, enzymes (e.g., lysosyme) and phenolic compounds can be recovery and purified by ultrafiltration well-defined methodologies. Membrane-based separations, in particular ultrafiltration, are extensively used by food industry. However, improvements are still needed in virtually all applications.