Recovery of volatile fruit juice aroma compounds by membrane technology: Sweeping gas versus vacuum membrane distillation

The influence of temperature (10–45°C), feed flow rate (300–500L/h) and sweeping gas flow rate (1.2–2m³/h) on the recovery of berry fruit juice aroma compounds by sweeping gas membrane distillation (SGMD) was examined on an aroma model solution and on black currant juice in a lab scale membrane distillation set up. The data were compared to recovery of the aroma compounds by vacuum membrane distillation (VMD). The flux of SGMD increased with an increase in temperature, feed flow rate or sweeping gas flow rate. Increased temperature and feed flow rate also increased the concentration factors (Cpermeate/Cfeed) of the aroma compounds. At 45°C the most volatile and hydrophobic aroma compounds obtained the highest concentration factors: 12.1–9.3 (black currant juice) and 17.2–12.8 (model solution). With black currant juice a volume reduction of 13.7% (vol.%) at 45°C, 400L/h, resulted in an aroma recovery of 73–84vol.% for the most volatile compounds. Compared to VMD, the aroma recovery with SGMD was less influenced by the feed flow rate but more influenced by the temperature. Higher fluxes were achieved during concentration by VMD and this reduced the operation time, which in turn reduced the degradation of anthocyanins and polyphenolic compounds in the juice. Industrial relevance

High temperature evaporation is the most widely used industrial technique for aroma recovery and concentration of juices, but membrane distillation (MD) may provide for gentler aroma stripping and lower energy consumption. This study gives important clues about the fate of berry juice aroma compounds and polyphenols during concentration by MD, and identifies the main factors influencing the aroma recovery efficiency with MD. Both SGMD and VMD are promising techniques for gentle stripping of berry juice aroma compounds and deserve further consideration as alternative techniques for gentle aroma stripping in industrial fruit juice processing.