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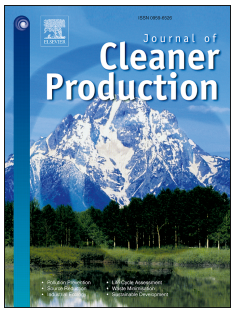

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Life Cycle Assessment of emerging technologies: the case of milk Ultra-High Pressure Homogenisation

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Abstract

Milk is becoming a key food commodity as population grows and demand increases. The treatment of milk to extend its shelf life is thus an important step in avoiding losses and optimizing resource use. The drawbacks of the most common treatments for shelf stable milk are the loss of nutritional values and high energy consumption. Ultra-high pressure homogenisation (UHPH) is an emerging technology relying on dynamic pressure up to 400 MPa. The combination of high pressure, temperature, shear, cavitation and impingement can provide commercially sterile milk of higher quality and longer shelf life. A life cycle assessment was performed comparing this emerging technology to the common thermal treatment: indirect ultra-high temperature sterilisation combined with non-aseptic homogenisation. The results show that high-pressure based processing has a lower environmental burden compared to the high-temperature based processing, already at pilot-scale, and this difference is primarily due to the lower electricity consumption. Additionally, upscaling considerations were made using power laws and scenario analysis to simulate future full-scale applications of UHPH. The upscaling shows that a decrease in carbon footprint up to 88% is achievable with improvements in efficiency. UHPH could, therefore, represent a substitute for existing practices considering its technological readiness level and potential synergies when integrated into industrial scale production lines.

Keywords Upscaling, high-pressure based processing, sterile milk, food supply and waste