Electrostatic separation for sustainable production of food ingredient

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Background

Conventional wet extraction of food ingredient consumes copious water and energy. Dry fractionation could be a more sustainable alternative. An example is to enrich arabinoxylan (AX) from wheat bran. AX is a dietary fibre with health benefits, e.g. lowering cholesterol and glucose uptake and reducing risk of chronic diseases.

Objective

To develop a novel dry separation process for more sustainable food ingredient production, by using electrostatic driving force or by combining different driving forces.

Experimental set-up of electrostatic separation (ES)

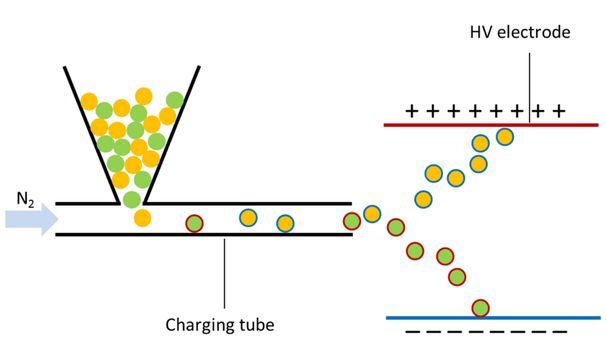


Figure 1. (Upper) Schematic drawing of the electrostatic separation process: particles are blown through the tube to let the particles take charge by tribo-electrification. Then the two fractions with different charge are separated in a high-voltage electrostatic field.

Figure 2. (Right) Newly developed electrostatic separator, with controlled material dosing rate and adjustable electric field

Separation of wheat bran to enrich arabinoxylan (AX)

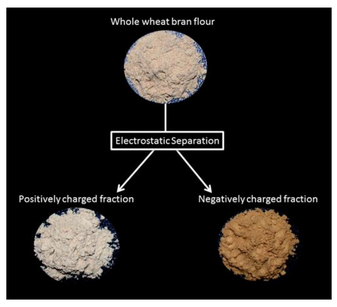


Figure 5. ES of wheat bran

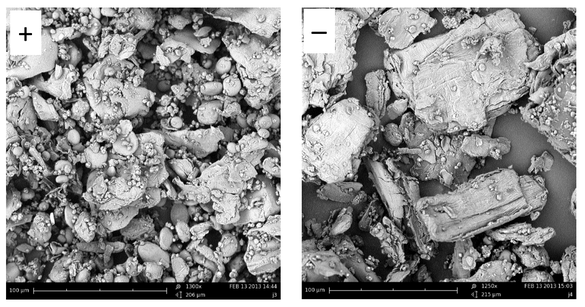


Figure 6. Scanning electron micrograph of two fractions

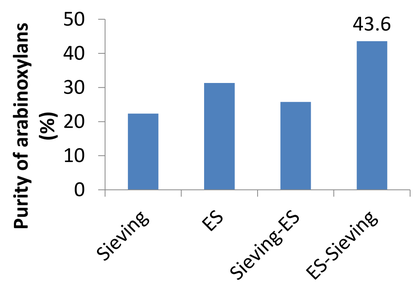


Figure 7. Comparison of fractions rich in AX obtained by different separation processes

- AX are enriched in negatively charged fraction.
- Combining ES and sieving leads to a purity of 43% dm, which is similar to wet-processed AX fraction.

Tribo-electrification of polystyrene microspheres

The influence of particle size, gas velocity and tube length on triboelectric charging was tested with polystyrene microspheres. As shown in figure 3 and 4.

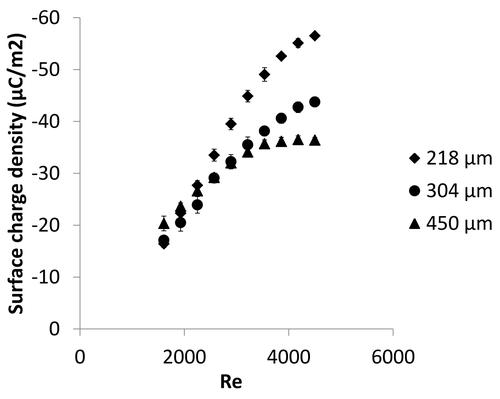


Figure 3. Influence of particle size and gas velocity

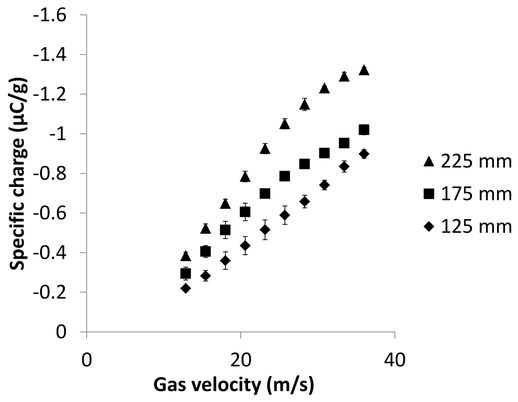
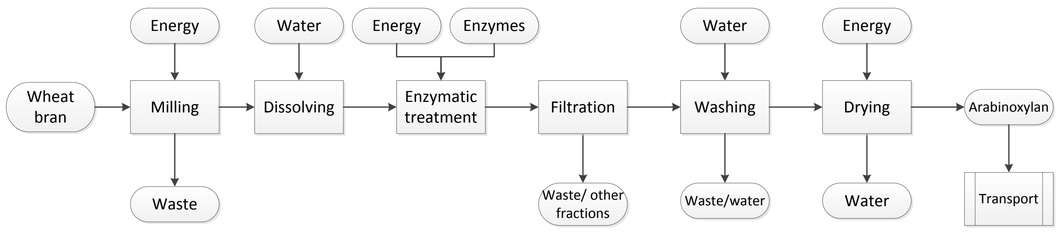
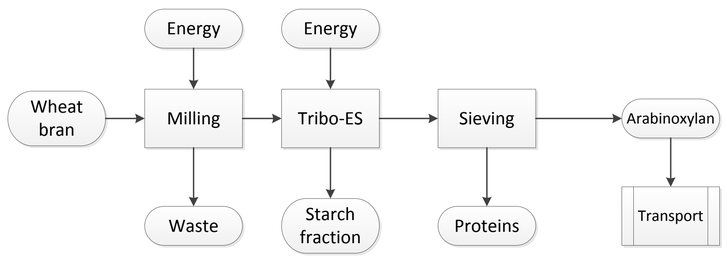


Figure 4. Influence of tube length

Sustainability comparison of wet & dry AX production



Wet process: **22** m3 water / kg AX, **62** MJ / kg AX



Dry process: **No** water, **0.04** MJ / kg AX

Conclusions

Electrostatic separation, alone or combined with other dry separation techniques, can be a more sustainable process for food ingredient production.

Acknowledgements

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