

Innovative Powders from Malt Extract

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Abstract

Malt extract is an important ingredient in the food and beverage industry because of colouring and flavouring properties. Compared to sugar-colouring agents malt extract is a pure food and no declaration is necessary. After boiling the wort is concentrated by subsequent vacuum evaporation until a dry matter of usually 60–80% is achieved. Such concentrates often show unfavorable properties, which mainly result from their viscosity and cause difficulties in further process handling. In process technology it is useful to transfer viscous, hard to dose liquids into an easy to handle powder form. Therefore various technologies have been developed to transfer malt extracts into dry form. Conventional processes as spray-drying or freeze-drying are expensive or operate with high temperature and they result in powders with strong hygroscopicity. Two innovative methods in spray technology were investigated to produce powders with improved handling properties from viscous malt extract. One method is called CPF technology (concentrated powder form) and is used with carriers like cellulose, starch or maltodextrin. The other is called PGSS drying (particles from gas saturated solutions). Both processes utilize the properties of supercritical CO₂, so that very gentle process conditions were used.

Material and Methods

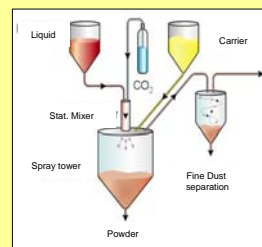


Fig. 1: CPF System

Variable	Range
Pressure [bar]	100-200
T [°C]	30-80
CO ₂ [kg/kg]	0,5-5
Pre-pressure [bar]	0-100

Tab. 1: CPF Variables

Goals: Production of free-flowing, spreadable bulk powders with reduced hygroscopicity, better storage behaviour and controlled quality and sensory characteristics.

Concentrated extract of malt made from 90% Pilsner malt and 10 % Carapils® by Weyermann with a dry matter concentration of 75 % was used for making powders of different quality.

CPF (Concentrated Powder Form):

The use of CO₂ as distribution medium under supercritical conditions (31,04 °C/ 71,8 bar) is chosen for evaporation. The liquid malt extract and CO₂ have a solubility depending on these conditions. During expansion of the CO₂ into gas at atmospheric pressure, the liquid is turned into a fine spray which adheres to the carrier powder in the spray tower as shown in Fig. 1. Under turbulent flow a well mixed homogenous powder is formed, which carries the the liquid. Very fine particles are filtered out in a dust separator. Variations are achieved by selecting conditions as in Tab. 1. Maltodextrin, Wheat flour 550 and Vivapur were uses as carriers.

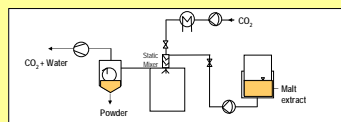


Fig. 2: PGSS System

PGSS-System (Particles from Gas Saturated Solids):

The liquid extract is heated to a max. temperature of 60 °C and pumped to a mixer, where supercritical CO₂ is added.

The pressure drop after expansion causes a major temperature drop (Joule-Thomson-effect) and small droplets are formed. The removal of evaporating gas containing also water of the sample causes a drying effect. The formation of the powder mainly depends on the pre-expansion pressure and the solvent ration (SR).

The variation of experiment settings leads to different powder characteristics like flowability, bulk density, compaction, average particle size and form.

Flowability was measured with shear cell.

Results

Results of CPF Trials:

Different pressures result in different bulk densities. Fig.3 shows the result using the different carrier powders. Wheat flour has the highest density and largest particle sizes.

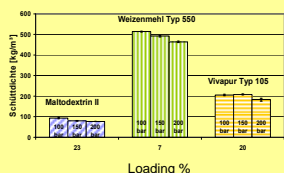


Fig. 3 : Bulk density caused by different pressures

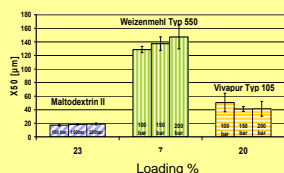


Fig.4 : x50 particle size at different pressures

Results

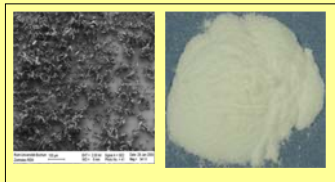


Fig. 5 : Vivapur unloaded (REM and photo)



Fig. 6: Vivapur loaded (REM and photo)

The flowability is better in powders on carriers, produced with CPF. Depending on the carrier well flowing non-adhesive powders can be made. Starchy products like wheat flour are suitable for food supplements. Courser agglomerates can carry upto 70 % by wt.

Maltodextrin takes the highest loads as a carrier, while starch (wheat flour) takes only 20%. Courser agglomerates show better flow less hygroscopicity. For the CPF method the malt extract has to be diluted.

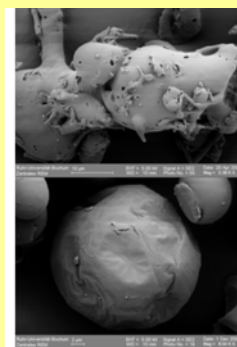


Fig. 7: PGSS dried, fine 2% moisture

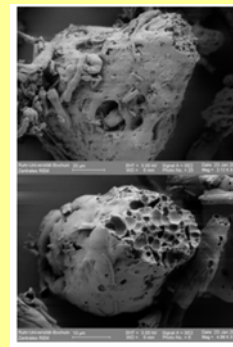


Fig. 8: PGSS dried, coarse 4% moisture

Powders made with the PGSS method show higher hygroscopicity than CPF powders. The microporous structure caused at different solvent ratios shows a range of small particles (Fig. 7) upto courser 200 µm structures (Fig. 8). The increase in surface allows faster and higher water uptake. The heat load of the PGSS system is higher than the influence with CPF.

Both spray methods exclude oxygenation of the product.

Conclusion

The handling of powdery new malt extract products offers new applications in food and beverage technology. New fields can be instant products, bakery products and other foods like sauces, cereal products and baby food. Novel ingredients in beverages are opened and even in pharmaceutical nutrition products or food additives.

The controlled influence of temperature and the reduction of oxidation leads to malt extract products with new characteristics. Especially products derived from CPF method on carrier substances offer improved physical handling properties, better flowability and can prevent adhesion behaviour of usually hygroscopic powders.



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