Application of radio frequency drying on soybean residue

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INTRODUCTION

The soaking soybean can be squeezed to soybean milk and soybean residue. The soybean residue still contains a lot of nutrients and is suitable for animal feed [1]. However, a mass of soybean residue has high moisture content and needs to dry for industrial application. Although soybean residue can be dried by hot air drying, but it requires long time to accomplish due to heat transfer resistance. Radio frequency processing (RF) is the use of rapid alternating electric field technology, then rotational vibration of the polar water molecules and rapid movement of ions cause friction and heat in the sample. [2] Therefore, RF-cold air drying can significantly reduce drying time and energy consumption than conventional hot air drying. Moreover, soybean residue from soybean milk still has high total polyphenols content and scavenging effect of DPPH free radicals, which may be affected by different drying method. [3] Therefore, RF-cold air drying could be suitable application for soybean residues in industry.

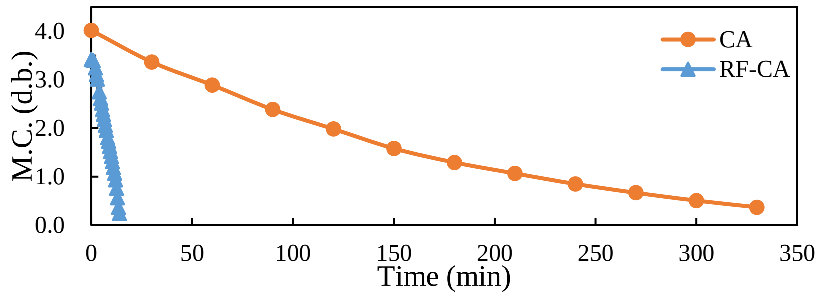
METHODOLOY

A 5 kW, 40.68 MHz pilot-scale RF with cold air drying system was used in this study. The size of the parallel electrode plates were 35 cm x 35 cm. The soybean residue was placed in a PP plastics bucket and put on the bottom of RF electrode plate. The RF power was obtained by adjusting the gap between the electrodes from 10 to 22 cm. The surface temperature profiles of 1.5 kg soybean residues after RF-cold air drying were measured by IR sensor at three different locations. Moreover, the weight loss of soybean residue was determined at different time interval to obtain the drying rate and drying curve.

RESULTS

The RF-cold air drying of soybean residues required only 22 min to accomplish drying processing, compared with 330 min cold air drying. (Fig. 1) The final temperature and moisture content of soybean residues by RF-CA drying were 88℃ and 0.12 kg water/ kg dried material, respectively. (Fig. 2) RF-cold air drying can significantly reduce drying time and energy consumption (Table 1).

Fig. 1. Drying curves of soybean residues by cold air (CA) and RF-cold air drying (RF-CA).



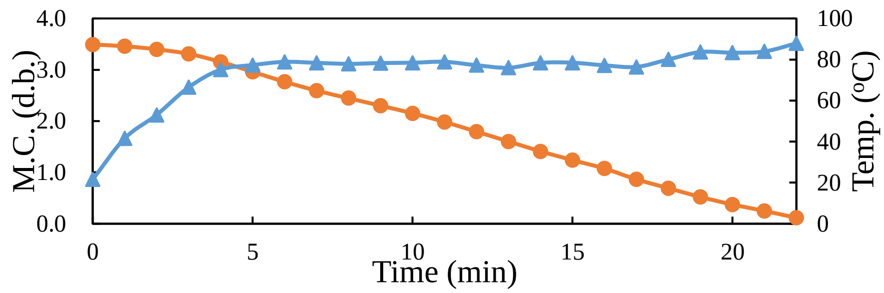


Fig. 2. The drying curve and temperature profile of 1.5 kg soybean residue by RF-CA drying.

Table 1. The drying rate, drying time and energy consumption of drying soybean residue

Drying conditions	Drying rate (g/min)	Drying time (min)	Total energy (kW)
RF-cold air drying	52.3	22	2.31
Cold air drying	2.14	330	13.53

DISCUSSION

The drying rate of soybean residues was 52.3 g/min, and it only took 22 min to accomplish by RF-CA drying.

CONCLUSION

RF-cold air drying is very suitable application for soybean residues in food industry due to shorter drying time, faster drying rate and less energy consumption.

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