

## SEPARATION BEHAVIOUR OF SMALL FOREIGN OBJECTS IN DRY FOODS

Shunsuke Takeda<sup>1</sup> and Masato Saeki<sup>2</sup>

<sup>1</sup> Graduate school of Engineering and Science, Shibaura Institute of Technology, 3-7-5 Toyosu, Koto-Ku, Tokyo, md20052@shibaura-it.ac.jp

<sup>2</sup> Dept. of Mechanical Engineering, Shibaura Institute of Technology, 3-7-5 Toyosu, Koto-Ku, Tokyo, saeki@sic.shibaura-it.ac.jp

**Key Words:** *Electric Field Strength, Electrostatic Separation, Finite Difference Method, Food Safety, Foreign Objects*

When we consume food, we usually do not expect to find foreign objects in it. Foreign objects in food products may pose several health concerns. Thanks to a continuous improvement of separation techniques in food industry, food manufacturers and the suppliers recently became able to catch most foreign objects that does not belong in the product<sup>[1],[2]</sup>. However, it is difficult to detect small foreign objects such as hair and soft plastics in dry foods. The reason is that it is easy for small foreign objects to adhere to dry foods due to electrostatic force. Therefore, an electrostatic separator of small foreign objects in dry foods was developed in our laboratory. The separator consists of an inclined rotating drum, which is grounded, a cylindrical electrode fixed at the centre of the drum and a suction device. The cylindrical electrode has some needle electrodes. The principle of the separation is based on the difference in the charge per unit mass of the dried food and foreign objects. The mixtures to be separated are charged using a corona charging device. When the charged mixtures are fed on the inclined rotating drum, foreign objects are attracted to the drum electrode and are recovered with the suction device. As dry foods are much heavier than small foreign objects, they are recovered at the end of the inclined rotating drum. Therefore, the mixtures can be separated because of the different positions to which they are recovered. Although it was found that it is possible to obtain a high purity and a high recovery rate using the separator, the understanding of the separation mechanism is still limited.

In this study, we numerically investigated the separation behavior of foreign objects and dry foods in inclined rotating drum. The behaviour of the foreign objects and dry foods was calculated considering the electrostatic force. The electric field strength was calculated using the finite difference method. The effect of amount of charge per unit particle mass and the rotating speed of the inclined drum on the trajectory of the particle was investigated.

### REFERENCES

- [1] H. Meftah, and E. A. Mohd, Detection of foreign bodies in canned foods using ultrasonic testing, *International Food Research Journal*, Vol. 19(2): 543-546, 2012.
- [2] H. Einarsdóttira, M. J. Emerson, L. H. Clemmensena, K. Schererb, K. Willerb, M. Bechb, R. Larsena, B. K. Ersbølla, and F. Pfeifferb; Novelty detection of foreign objects in food using multi-modal X-ray imaging, *Food Control*, Vol. 67, 39–47, 2016.