2003 MAFMA Final Report

Project Title	**Quick screening tests for electrostatic powder coating**
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Academic Institution	**The Ohio State University**
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1. Objective Summary

The objectives of this project were to decrease testing time for electrostatic powder coating by developing new test methods, categorizing powders likely to be effective, and using sensory evaluation to determine if consumers have a preference for electrostatically versus nonelectrostatically coated foods.

2. Objective Accomplishments

Testing methods to measure the ability of a powder to pick up a charge.
The 4 methods that were tested were resistivity, charge decay time, adhesion and charge to mass. The equipment was purchased and the methodology developed for testing the four methods. Resistivity was found to be useful in predicting adhesion, but was less useful in predicting transfer efficiency and evenness of coating. The most useful benefit of the resistivity method turned out to be in very accurately predicting the transfer efficiency and evenness of liquid electrostatic coating, which was the subject of the prior year's MAFMA project. Charge decay time also correlated to adhesion, but was less sensitive than resistivity. The adhesion test was found to mainly measure cohesiveness of the powder rather than ability to pick up a charge. The test is still used as a cohesiveness measurement, but not as a test method to measure charge. The charge to mass was a good predictor of transfer efficiency, evenness and adhesion. Thus charge to mass is what is being used in ongoing studies, and is the method we have recommended to companies.

Determine if powders can be categorized by composition
The powder composition affects its charge to mass, cohesiveness and other important properties, however attempts to categorize powders by composition were unsuccessful. Powders that perform very well, and very poorly, in an electrostatic coating system could be found in every composition category. Thus we concluded that the success of a coating process cannot be predicted from the composition alone.

Analytically determine if electrostatics produces more even coating than nonelectrostatic coating

Using a microscope and computer software, a method was developed to analytically measure the evenness of seasonings applied to potato chips. Using image analysis, the relative standard deviation of the percent of the chip that was coated was found to accurately measure the sensory panel's evaluation of the evenness. Using an analytical method will allow many more samples to be analyzed then would be possible if sensory evaluation had to be done for each sample. With the method developed, the next step is to compare chips coated electrostatically and nonelectrostatically. Because of time restraints, this will not occur until after this MAFMA project is officially completed.

Use sensory evaluation to determine if consumers have a preference for electrostatically versus nonelectrostatically coated foods.

Potato chips were coated electrostatically and nonelectrostatically with four different commercially available seasonings and presented to panelists. Overall acceptance and appearance of the electrostatically coated samples was higher than the nonelectrostatically coated samples. There was no difference in texture or flavor of the samples. Thus, consumers do prefer electrostatically coated potato chips.

3. Unexpected findings, if any

Charge decay was expected to be an excellent test, but was not as sensitive as other tests. The resistivity was expected to be a good test, but it was not expected that it would be an excellent test for predicting the quality of liquid electrostatic coating, which was the prior MAFMA project. Compositional effects were weak and can not be used as a method for determining the effectiveness of coating.

4. Practical impacts of research efforts.

a. Short Term Impacts

The industrial partner purchased an electrostatic unit to continue testing in-house, on the basis of positive results obtained in this project.

The methods developed in this project were shared with the industrial sponsors. They are also being used in continued research in this laboratory. This has resulted in several more grants, from MAFMA, other companies, and other granting agencies.

b. Long Term Impacts

The methodology developed for the different test methods allows faster testing to determine under what circumstances electrostatic coating is beneficial. Since powders cannot be categorized by composition, it is essential to measure the physical properties to determine if a powder is a wise choice for electrostatic coating.

Sensory evaluation indicates that electrostatically coated samples are more evenly coated and more preferred than nonelectrostatically coated samples, indicating that the technology can be used to increase profitability.

5. Publications resulting from this research.

Biehl H, Barringer SA. 2004. Comparison of the effect of powder properties on coating transfer efficiency and dustiness in two non-electrostatic and electrostatic systems. Innov Food Sci Emerg Technol 5(2):191-198.

Reyes C, Barringer SA. 2005. Evenness of seasoning measured by image analysis, colorimetry and sensory evaluation. J Food Process Pres 29(5): 369-377.

Ratanatriwong P and Barringer SA. Effect of powder particle size on electrostatic and nonelectrostatic powder coating. Innov Food Sci Emerg Technol submitted.