AGROTECHNOLOGY & FOOD SCIENCES GROUP
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Food coatings by electrostatic atomization

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Introduction

Thin film coating is a very popular processing method to produce foods with an attractive appearance and improved quality attributes. A novel, efficient coating method but less commonly used in food industry is electrostatic atomization which utilizes electrostatic forces to overcome surface tension and generate wide cone-shaped fine spray of charged micro droplets that yield high transfer efficiency (80%), and uniform distribution over target material for ultra thin film production.

Results and Discussion

Droplet size on target, influenced by flow rate and conductivity, are bigger at high flow rate and low conductivity (Fig 1). The experimental values are in good agreement with model.

Spreading of droplets on target may be either completely random (Fig 2a) or influenced by charge of droplets present on surface which result in minimum overlapping and effective surface coverage (Fig 2b).

These two mechanisms were simulated by using Monte Carlo approach. Experimental results indicate that initially droplet deposition is random, but at higher concentrations, deposition profile may affected by charge interaction between droplets (Fig 3).

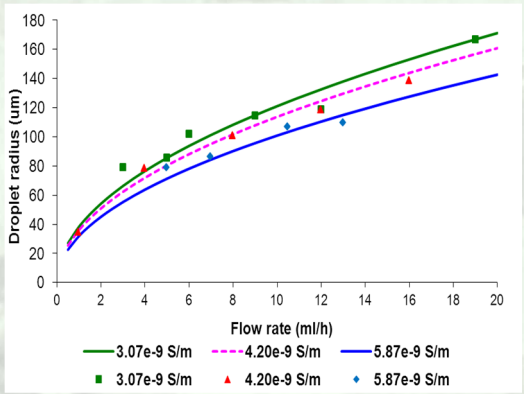

Figure 1: Average droplet radius as function of flow rate and conductivity of sunflower oil

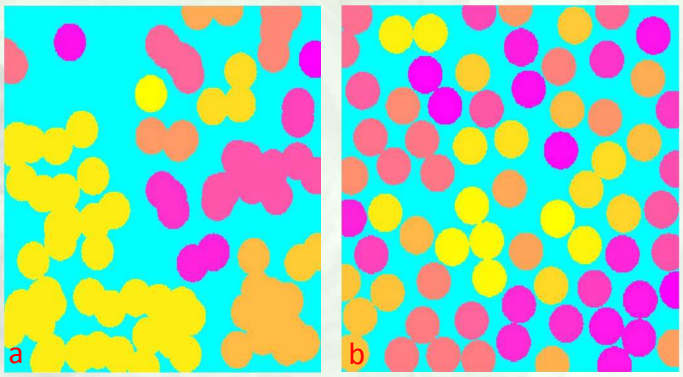

Figure 2: Deposition pattern of charged droplets over target surface; a) Random, b) Gap filling

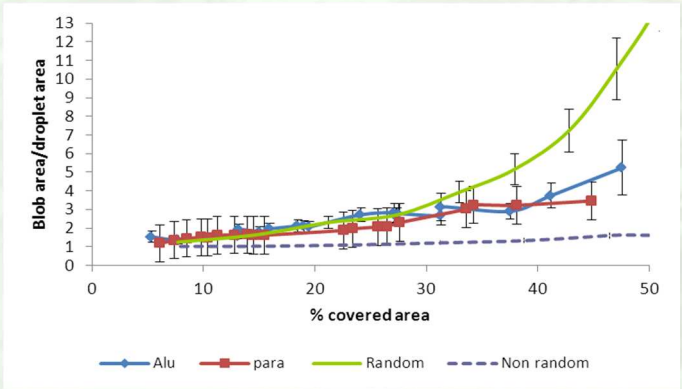

Figure 3: Deposition pattern of sunflower oil on para-film and aluminium foil, 5ml/h having conductivity of 3.07e10-9 S/m

Conclusion

Flow rate and conductivity determine the droplet size of electrostatically atomized sunflower oil. Droplets are initially randomly distributed over target surfaces; contributing toward better understanding of film formation mechanism by electro-spraying.

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Food quality and shelf-life is strongly affected by coating of foods and determines the exquisite taste. It creates a protective moist barrier to maintain the crispiness of the products. There is a great demand for efficient coating methods for foods and electrostatic coating holds promise owing to the evenness in coating, high transfer efficiency and produces less dust & waste compared to conventional non-electrostatic powder coating and liquid spray coating. Application of electrostatic coating for production of food coatings is not widely spread. Depending on the type of coating formulation a different coating electrostatic technology can be applied. For liquid, Electrohydrodynamic (EHD) atomization is a method that utilizes electrical forces to overcome the surface tension force and break up a falling film into very small droplets. Varying the spraying mode (flow rate), liquid properties (conductivity) droplets of 50μm are produce which provide a thin (±20 μm) and homogeneous coatings layer. It was also observed that the thickness of the coating layer vary with wettability behaviour of spraying liquid materials and target surfaces.