Phase Separated Polymer Microparticles as Pollen Biomimetics

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Pollen are the carriers of the genetic material of flowering plants. There are more than 250,000 different flowering plants, and each one has a characteristic type of pollen, which differs in size, shape and surface ornamentation. The outer surface of a pollen, the exine, is made of a yet poorly characterized polymeric material called sporopollenin [1]. It is very resilient against heat and corrosive liquids and it has the purpose to facilitate pollen transport (by insects or wind), and to protect the DNA from degradation during transport in harsh environments (UV light [2]; dry or humid conditions).The surface structure of the exine most likely develops through a phase separation mechanism during sporopollenin formation [3], but the details are poorly understood. It has been reported that emulsions containing lipids can be used as sporopollenin mimetics [4-5] to shed light on the phase separation mechanism.
We aim to mimic the formation of microparticles with certain surface structures by another approach - using oil-in-water emulsions of polymer blends or polymer/inorganic particles. By evaporation of such emulsions, we found that microscopic beads can be obtained [6]. Their surface structure depends on the type and concentration of the water-based emulsifier, and the type, concentration, and mixing ratio of the polymer blend. We found that PMMA/polystyrene mixtures generally give phase separated particles with large domains of each polymer, while using polysulfone as one component in the oil phase leads to spherical surface decorated particles. The surface structures were investigated by SEM, and the internal structure by fluorescence microscopy (by using tetracyanobenzene as a fluorescence probe.

References

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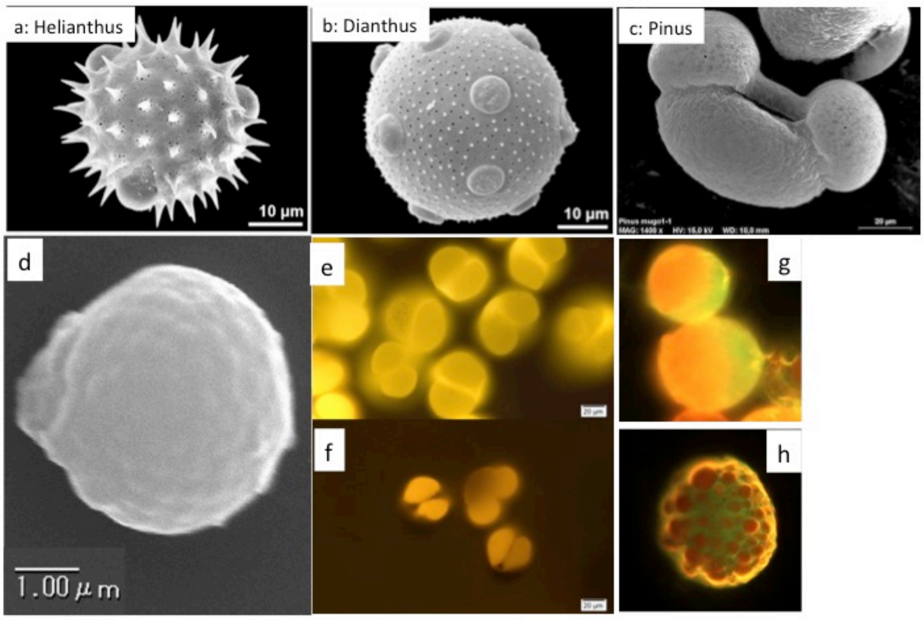
Figures



a-c: SEM images of 3 types of pollen; d:polysulfone/PMMA polymer particle; e: pinus pollen fluorescence at room temperature; f: pinus pollen after heating to 300°C for 5 min; g,h: microscope images of fluorescence-stained polymer particles (polystyrene is red, PMMA is green).