

乾燥中の水面における界面活性タンパク質の皮膜形成

Coat formation of surface-active proteins on aqueous surfaces during drying

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Abstract

Segregation of the protein bovine serum albumin (BSA) and lactose in thin aqueous films during drying was investigated by examining the composition of the dried films using inverse micro Raman spectroscopy (IMRS) and X-ray photoelectron spectroscopy (XPS) sputter-depth profiling. The composition was uniform through the thickness of the dried films except within a 10 nm region at the exposed surface where BSA had accumulated, most likely due to its surface activity. The thickness of the BSA layer was similar to the diameter of a BSA molecule, which suggests that a single monolayer of BSA adsorbed at the exposed surface. The BSA surface concentration of the dried films was constant over a wide range of BSA bulk concentrations, indicating that the aqueous surface became saturated with BSA during drying. The BSA surface layer of order 10 nm was significantly thinner than the film thickness of order 10 μm , which implies that BSA formed a surface coating rather than a shell, and thus lent no structural rigidity to the film.

要約

乾燥中の薄膜フィルムにおけるウシ血清アルブミン (BSA) とラクトースの分離を顕微ラマン分光法 (IMRS) と X 線光電子分光法 (XPS) を用いたスパッタ深さプロファイリングによって評価した。BSA が集積した塗膜表面 10 nm 以内の領域を除いて、塗膜成分は均一であり、この BSA 層厚は BSA の分子直径にほぼ等しいため、塗膜表面での BSA 単分子膜形成が示唆された。また、乾燥塗膜表面の BSA 濃度はバルク濃度に比べて濃く、均一であるため、乾燥中の塗膜表面は BSA で飽和状態であると考えられる。約 10 nm の BSA 層厚は約 10 μm のフィルム膜厚に比べてかなり薄く、これは BSA が硬直性を付与しない表面皮膜を形成していることを意味する。