# Highly-ordered microgel monolayers for precise and localized biomolecule capture: towards diagnostic and biosensing platforms

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Thermoresponsive microgels composed of poly(N-isopropylacrylamide) (pNIPAM) and poly(N-vinylcaprolactam) (pVCL) are self-assembled into ordered monolayers at liquid interfaces and transferred onto glass substrates via Langmuir-Blodgett deposition. Their colloidal stability and morphological changes under different liquid media, including phosphate-buffered saline (PBS), Dulbecco's Modified Eagle Medium (DMEM), supplemented DMEM (cDMEM), and HEK-293 cell culture, are evaluated via in-situ fluid-cell atomic force microscopy (AFM). Although both microgels show biocompatibility, only the softer pVCL ones remain structurally stable after incubation and cell removal, enabling reproducible microscopic characterization. Irreversible protein adsorption and exosome capture by pVCL microgels are confirmed by fluorescence microscopy, AFM and FTIR spectroscopy, and quantitatively estimated through AFM-based volumetric analysis and UV-vis microplate reader measurements. These findings establish that soft, low-crosslinked pVCL microgels are promising candidates for bioactive surfaces with high molecular uptake capacity for biosensing, diagnostics, and biomedical applications.

**Keywords:**
Thermoresponsive microgel, pNIPAM, pVCL, Fluid atomic force microscopy, Biointeractions, Biomolecules

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