Portable Aerosol Sampler with Liquid Phase Set on a Drone for Biohazard Monitoring

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The purpose of the study is to develop a perspective portable liquid absorptive aerosol sampler for biohazard monitoring of surface atmospheric stratum with a drone. Early detection of pathogens is crucial for ensuring safe living conditions. Conventional sampling methods do not ensure the sustainability of captured microorganisms; most samplers have limited application scope as they are intended for laboratories. Cyclone-based liquid absorptive samplers are the most promising devices in this regard. In the study, a structure and base values of a cyclone collector were determined. The chosen design provides maximum particle capturing efficiency in terms of low air flow rate and small size of the collector. Projected capturing efficiency for particles of the size of 1mcm is approximately 20%, for particles of the size bigger than 2,5mcm is 100%. Mathematical modeling proved the correctness of theoretical considerations. This made it possible to design and fabricate a prototype of a sampler device which also includes a fan, a peristaltic pump, valves, a sensor for liquid levels monitoring, a display for operation mode controlling. Outdoor sampling on a drone has successfully tested performance efficiency. A study on capturing efficiency was carried out by sampling sucrose aerosol with a fluorescein dye in a microbiological safety box. Specific efficiency of our sampler is 1,18 [relative units/(liter/min)], which is over twice s.e. of 0,43 [r.u./(l/min)] of existing laboratory devices. Portability, mobility, and efficiency of fabricated bioaerosol sampler open up extensive prospects for meeting the challenges of biosecurity and biosafety.

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