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A PROMISING METHOD OF LIQUID SEPARATION IN ORBITAL STATIONS' LIFE SUPPORT SYSTEMS

Abstract

In life support systems (LSS) of manned orbital stations a liquid is carried by an airflow from which the liquid should be separated. In this connection, practically all the life support systems employ the process of liquid separation from a gas/liquid flow. In zero-gravity condition the behavior of gas-liquid interface is determined by surface energy, capillary forces, wetting processes and inertial forces. In order of operate in zero gravity two types of separator are possible to use, namely, static and centrifugal separators. The main advantages of static separators are high reliability and minimal power consumption. Centrifugal separators feature high operational life but require more power to operate. For orbital stations' life support systems with scheduled delivery of replaceable units it is feasible to use static methods of liquid separation to reduce power consumption. Below are given basic types of static separator which can operate in zero gravity. They are a separator which uses a moisture-retentive material for liquid collection, a crankshaft separator which uses a moisture-retentive porous material and collects a liquid in those places where a gas/liquid flow changes its direction, a hydrophobic/hydrophilic separator, a vortex separator which uses water droplet inertia in a high-rotation gas/liquid flow. The above separators are unable to effect complete gas-liquid separation because of back of water seal and are used usually as the first separation stage. One of the most effective and cost-saving ways of gas/liquid mixture separation in water recovery systems is the method based on the use of surface tension forces with a liquid removed through channel capillary-porous walls. This type of separator with porous metallic components operates in the system for water recovery from humidity condensate on the International Space Station. The service life of a separator with a porous tube stack is governed by clogging a capillary/porous barrier in liquid filtration. The present technologies make it possible to produce high-quality hydrophilic capillary/porous polymer membranes the structure of which enables water seal at operational gas/liquid differential pressures. The most important parameters are membrane wetting ability, critical differential pressure, dissolved air diffusion and separated liquid capacity. Testing of the separator with a hydrophilic capillary/porous membrane has proven the reliability and effectiveness of separation and resistance to increased liquid content in a gas/liquid flow and its contamination. The successful experimental operation of the separator on ISS is under way.