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HYGIENE WATER PROCESSING ABOARD A PROSPECTIVE SPACE STATION

Abstract

Water procedures and washing clothes are supposed to be presumed on board during long-term missions and will be carried out by special hygiene equipment such as hand, face and body wash equipment; washing machine; dishwasher etc. A significant volume of water is required for carrying out water procedures and washing. Therefore, a hygiene water processing system is required.

The hygiene water processing system was tested at the "Mir" space station. The system operation was based on filtration and sorption purification. Such a system was able to operate only with dissociating into ions detergents.

The prospects of introducing the closed loop of hygiene water supply on board are shown in this study. The task of hygiene water processing system development with high rates of water purification using conventional detergents was set. Theoretical and experimental research of a hygiene water processing method and technology providing the necessary water quality and a high degree of the water return have been conducted. The low-pressure reverse osmosis has been selected as the key method for water processing. The original scheme of the water regeneration process has been developed. The experiments on water purification were conducted on the reverse osmosis test stand operating on the technology based on preliminary filtration of contaminated water and subsequent low-pressure reverse osmosis purification on spiral wound modules. The sources of contaminated water were a hygiene water imitator and truly contaminated water obtained as a result of washing hands, taking a shower and washing clothes. The concentration process of the detergent and contaminants in the closed circulation loop was carried out to the maximum permissible concentration.

As a result, the efficiency of low-pressure reverse osmosis (in combination with the developed scheme) for hygiene water processing has been confirmed. Experimental studies have confirmed the possibility of returning 97% of water to the hygiene water closed loop. The operating pressure of reverse osmosis water processing was 0.8 MPa. The membrane selectivity in terms of detergent exceeded 99%.

The proposed method and scheme of hygiene water processing will help reduce hygiene and clothing supplies on board a space station and will provide the crew with good quality water. An important task is to conduct further research on the hygiene water processing issues including the problem of development and suppression of bacterial flora in the reverse osmosis closed loop. Designing sanitary and hygienic equipment for the crew is also essential.