

# **NEW FLEXIBLE POLYURETHANE FOAMS FOR FILLING RESIDUAL PLEURAL CAVITIES IN LUNGS**

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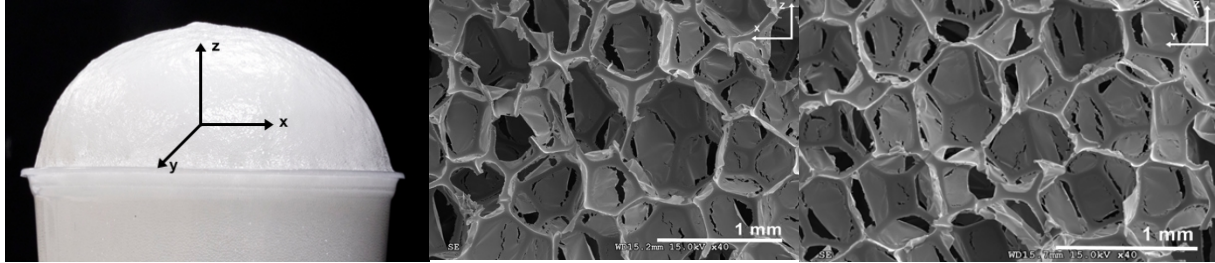
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Residual pleural cavity (RPC) originates by pleural pathological process or pulmonary resection and persists for long time becoming chronic. Several pathologies are responsible of the formation of RPC including tuberculosis, lung cancer, and congestive heart failure, among other. RPC are generally solved by using complicated surgical interventions that often lead to deterioration of the patient's quality of life. Alternatively, over the last decades, the filling of RPC with different synthetic materials has been proposed but this approach have not been successful until now, due to limitations of the tested materials in complete filling of RPC, this leading to infections. In this study, polyurethane foam (PUF) is proposed as new materials for in-situ filling and sealing of RPC.

The new concept proposed in this study consists of the use of two separate liquid components as precursors of PUF which are placed in two-compartment syringe; upon mixing of the two components in the applicator, PUF starts formation at the exit which is introduced into CPR, then expand into the irregular geometry of RPC and foam is formed within the cavity.

The composition of the two components of PUF precursors is as follows : Liquid component 1 contains trifunctional polyether, water, polymethyl siloxane, and two different catalysts. Component 2 is liquid isocyanate. Optimal formulation of PUF was determined by experimental design of experiments. Optimized PUF (H5 formulation) satisfies all requirements sought for filling RPC, having low density ( $17\pm 0.7$  kg/m<sup>3</sup>), relatively low maximum foaming temperature ( $51\pm 2$  °C), and foaming time of 7-10 seconds. PUF does not contain free NCO groups and the distribution of open cells is homogeneous in all

directions (Figure 1). However, the foaming time need to be extended because of surgeon requirement.



**Figure 1.** Photo of H5 foam and SEM micrographs in different directions.

Several different formulations were tested for improving the properties of H5 foam and they consist in mixing of polyols of different molecular weights and nature in distinct amounts. Finally, several PUFs with longer foaming time of 10-15 seconds were obtained.

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