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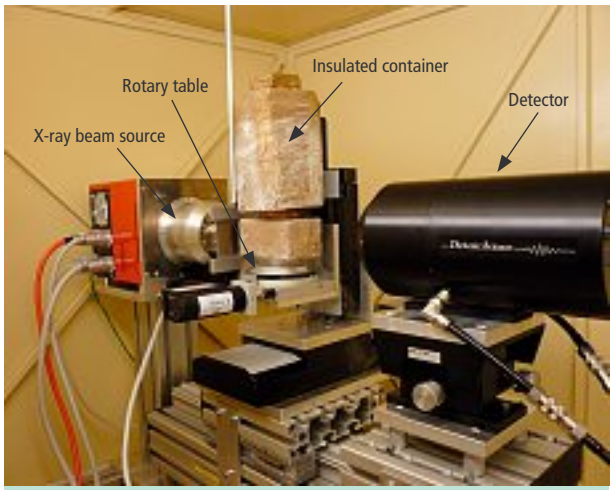

FIGURE 1 : The acquisition set-up at the Tomolab facility of Elettra (Trieste, Italy).

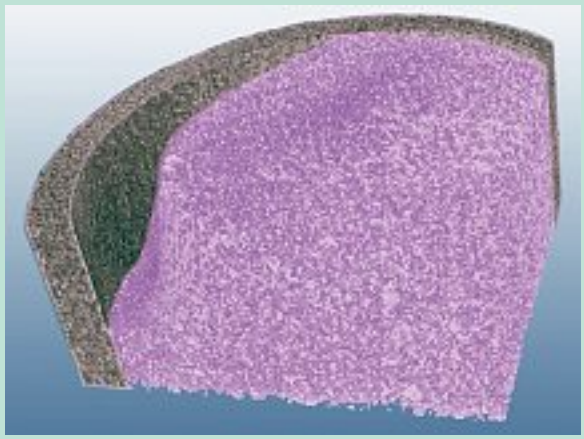

FIGURE 2 : A portion of the 3D reconstruction of a polidocanol foam (the external part of the tube is also visible).

There have been several attempts to standardize the foam using different devices (Turbofoam, Sterivein).

Furthermore, different techniques for the foam injection and materials have been described by various authors.

The aim of this work is to investigate the possibility and the significance of a morphology characterization of sclerofoams obtained under different preparation conditions.

Materials and Method

In this study, six sclerofoams samples were prepared in laboratory. According to the Tessari's method [13], we obtained the foam by mixing 20 or 50 times air and polidocanol drug (3% and 0.5% concentration) using two syringes and a three-way connector. Each foam was then injected in a Eppendorf tube using pipes of different dimensions (C1: 1.3 × 45 mm and C2: 0.3 × 13 mm) and immediately quick-frozen in liquid N_2 to avoid macro-crystals formation while preserving the foam structure during the measurements.

A non-destructive definition of the frozen sample three-dimensional internal structure was obtained by X-ray micro-Computed Tomography. The set-up used at the Tomolab facility of Elettra (Trieste, Italy) achieves a spatial resolution of 10 micron.

The sample, contained in a insulated box, is placed on a rotating table and several projections are acquired at different angles over 180 degrees **(Figure 1)**.

The 3D reconstructions **(Figure 2)** of the foams structures were analyzed and several morphological parameters such as number, dimensions and degree of isotropy of the bubble structures were computed [14, 15, 16].

Experimental Results

Differences can be easily observed in the structures obtained with different foam preparation methods, for example by examining the samples tomographic sections shown in **Figure 3**.

The morphological analyses were conducted on a 2003 voxel volume extracted from the central portion of the samples.

A quantitative characterization of the different foam microstructures can be attained by computing the histograms of the bubbles volume and of the bubbles wall thickness (obtained by Pore3D [4] and by Quant3D [5] software respectively), as shown in **Figure 4** and **Figure 5**.

Conclusions

An original experimental approach has been proposed, in which micro-tomography and morphological techniques have been successfully used to characterized the sclerofoams.

To our knowledge, this is also the first attempt to monitor sclerofoams for applied research purposes.

In this first step of the research, we were able to detect differences among the samples prepared in different conditions.

Nevertheless, in order to obtain quantitative results of clinical significance, a larger number of experimental observations is required and further work has already been planned.

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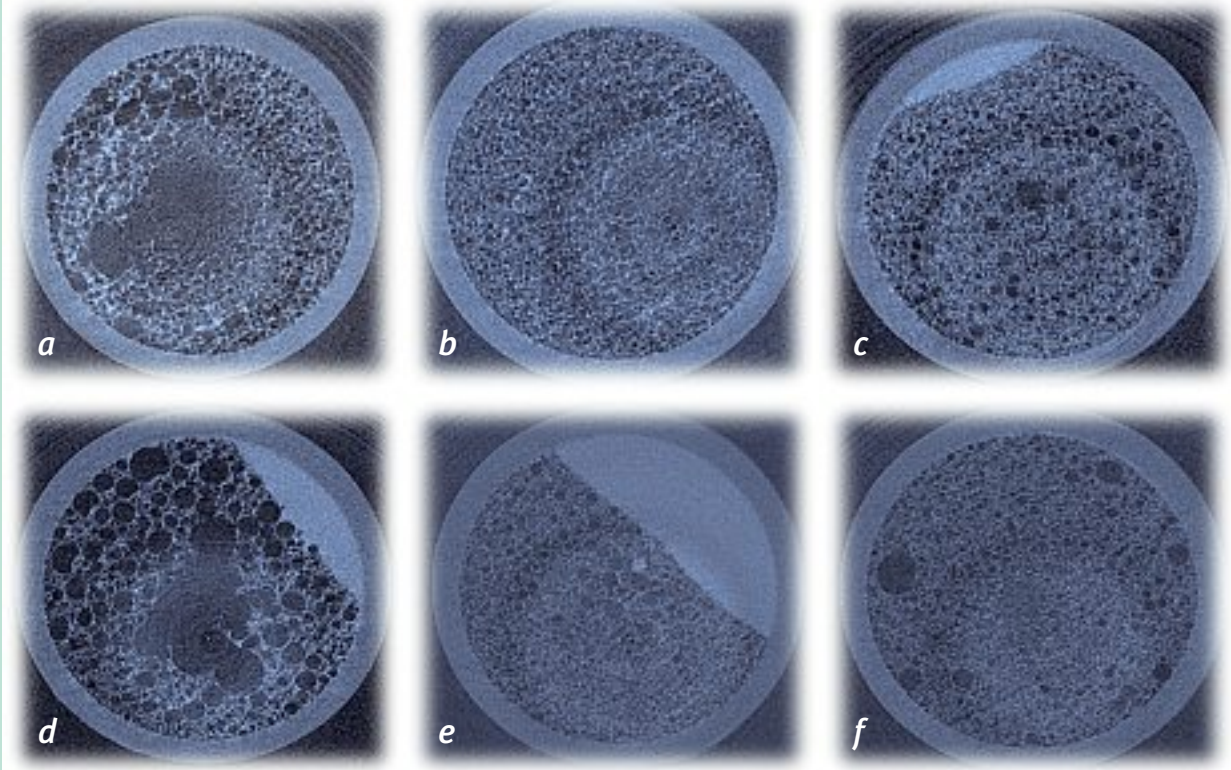

FIGURE 3 : Different foam structures obtained by varying the preparation parameters: (a) 3% 20 x C1; (b) 3% 20 x C1; (c) 0.5% 20 x C1; (d) 0.5% 50 x C1; (e) 0.5% 20 x C2; (f) 0.5% 50 x C2.

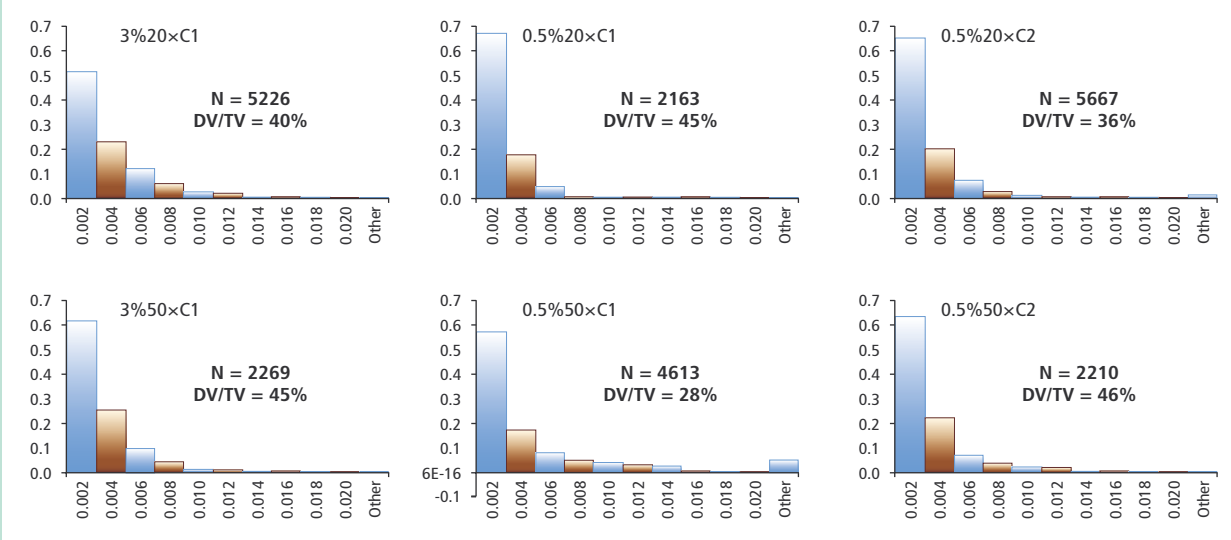

FIGURE 4 : Histograms of the bubbles volume.

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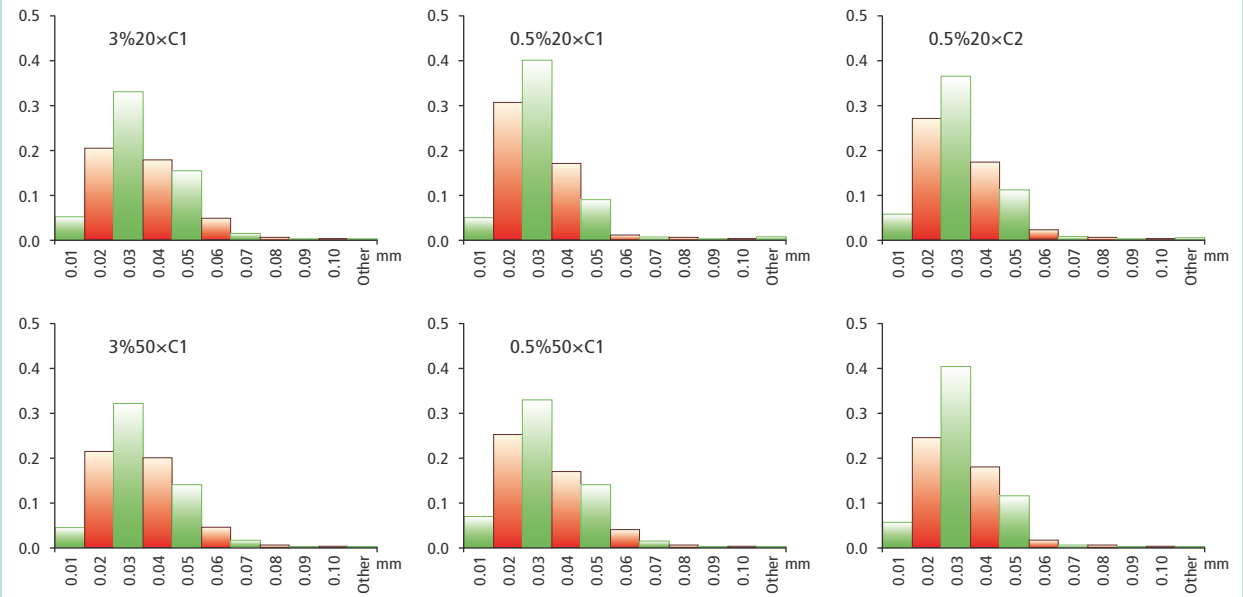

FIGURE 5 : Histograms of the bubbles wall thickness.

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