



Evaluation of mechanical properties of platelet-rich fibrin membrane:

Analysis in vitro

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INTRODUCTION

The use of autologous blood concentrated is an alternative to be considered for regenerative procedures when it finds failures for support of osseointegrated implants.

The PRF membrane (**leukocytes platelet-rich fibrin**) in polymerized and gelled form has function of a three-dimensional framework. This concentrate is composed of platelets, leukocytes and platelet micro particles. In addition, these concentrates has function to release growth factors. The presence of these elements can benefit the healing process, angiogenesis and bone neo-formation in the surgical area to obtain bone regeneration.

The concentrate is obtained after human blood centrifugation, without additives and this process can be performed through different forces and times; the literature demonstrated a wide variety of possibilities regarding forces and times for centrifugation. The centrifugation processes can influence the characteristics of the membrane.

Ganaati et al. concludes that when the membrane is obtained at a lower speed, the G force is lower, and it produces a more porous network of fibrin and concentrates a greater number of leukocytes and growth factors. Consequently, the greater the centrifugal force, more denser is the fibrin network and the less cellular the membrane.

Considering the variety of centrifugation protocols and their influence on the characteristics of the membranes obtained, **the literature demonstrates that is necessary to evaluate regarding the centrifugation protocol which can influence directly in the resistance of membrane according to traction.**

The aim of this study was to evaluate the mechanical strength of the fibrin membrane obtained through different centrifugation forces.

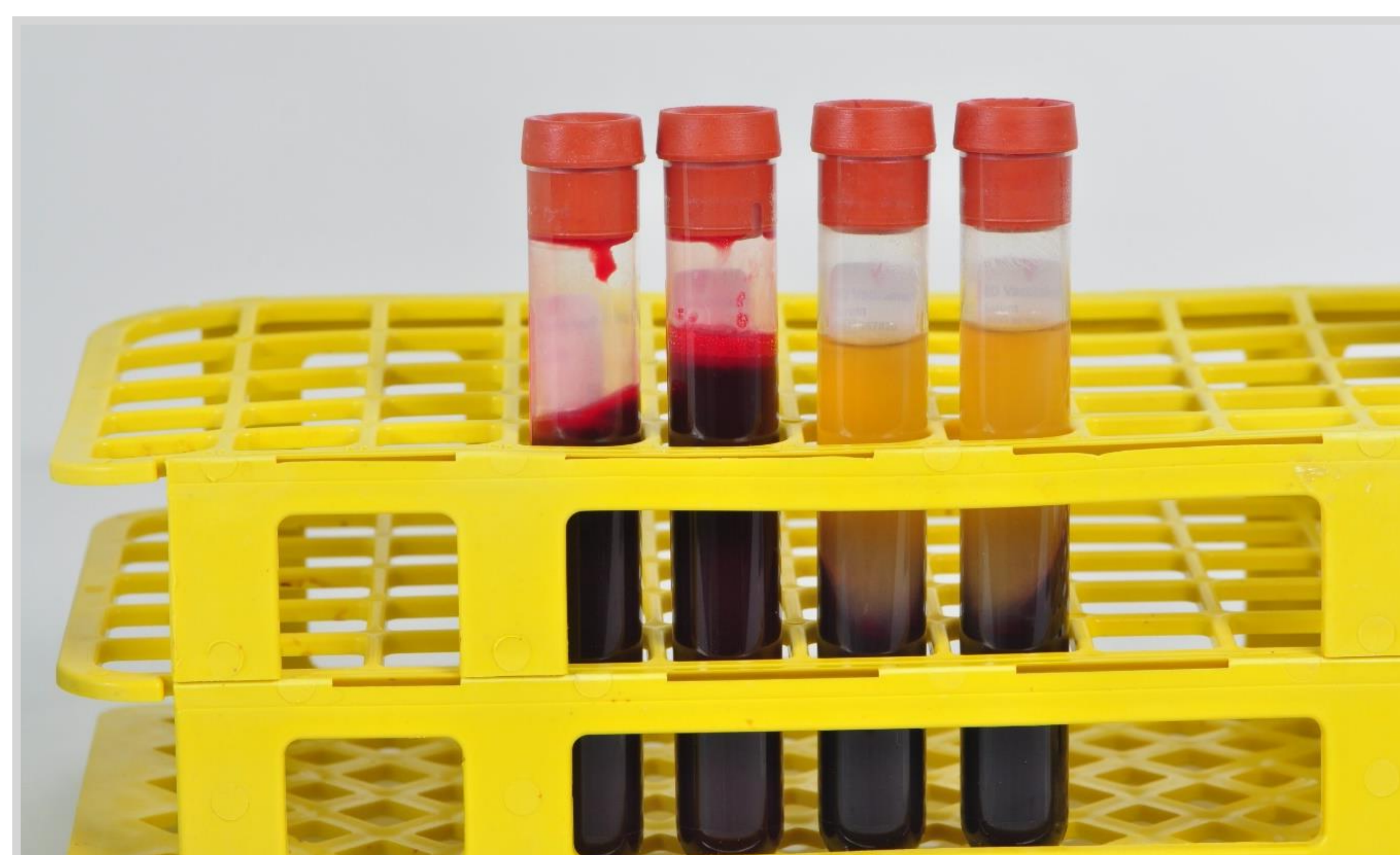


Figure 1: Tubes before and after centrifugation



Figure 2: Fibrin clot



Figure 3: Fibrin clot in PRF Box

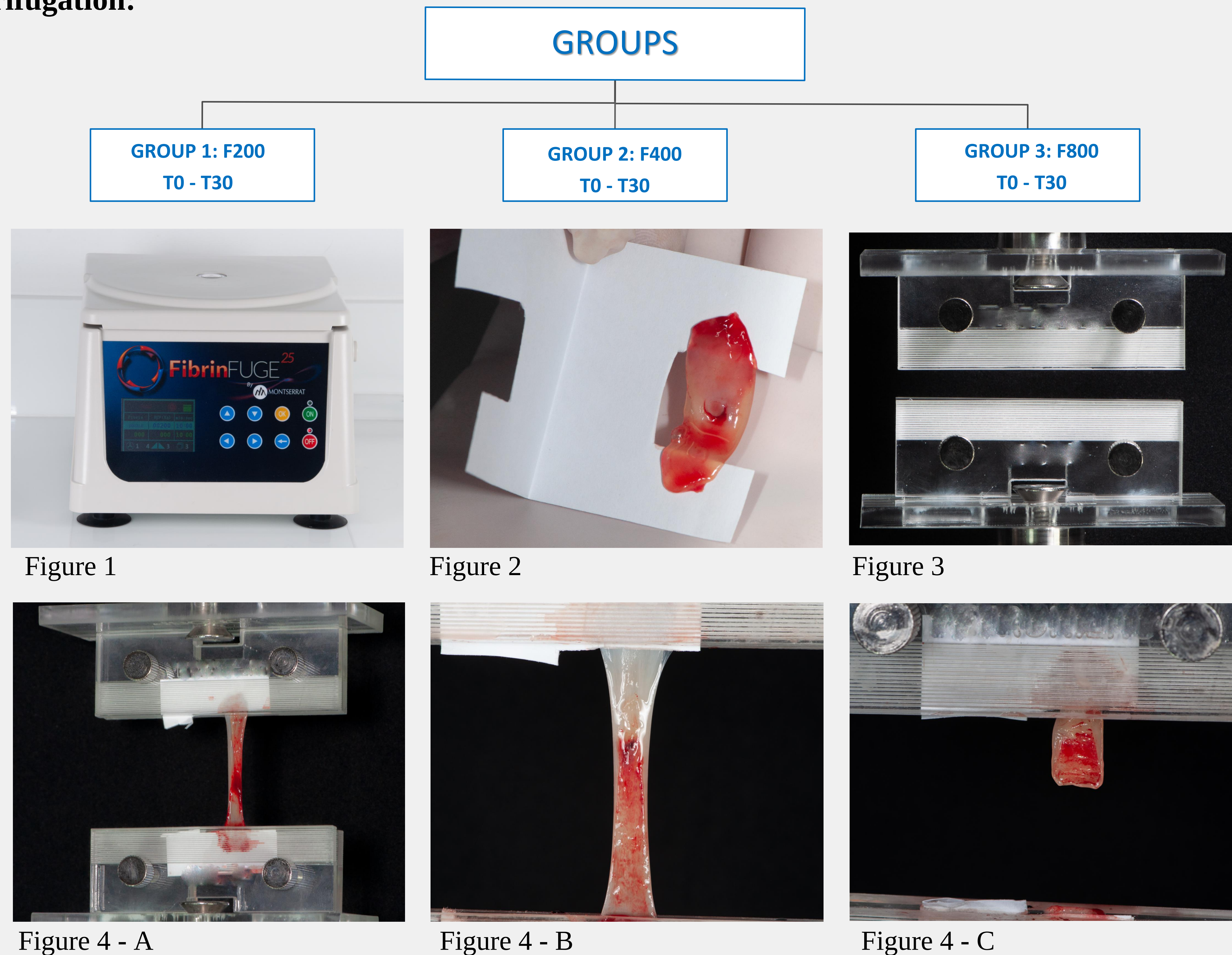


Figure 4: PRF Membrane

MATERIAL AND METHODS

To obtain the samples of this study, were collected 300 mL of blood from a patient donator (A young man, 34 years old and systemically healthy). The blood count were analyzes one day before to considered the patient with normal reference valued. The volume total was divided in 30 tubes, each one containing 10 mL.

The samples were divided in three groups, according to the g-force (F) applied during centrifugation:



RESULTS

Table 1 shows the value of the RF required to break up the membrane considering the differences on applied force and waiting time evaluated. No significant difference was observed regarding to the RF of the membrane used in the different studied times (T0 and T30), for any force applied in the centrifugation, such as, F200, F400 and F800.

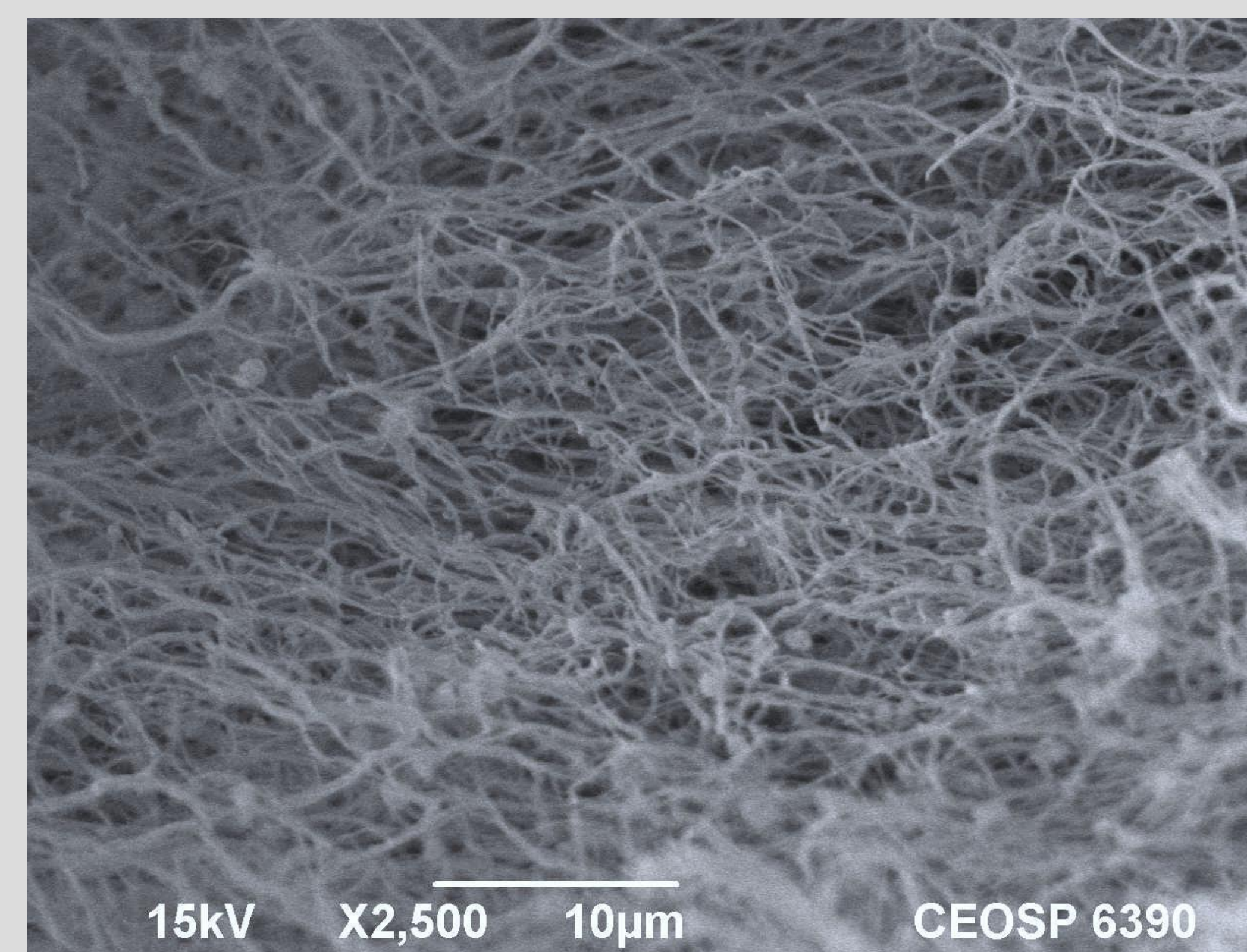
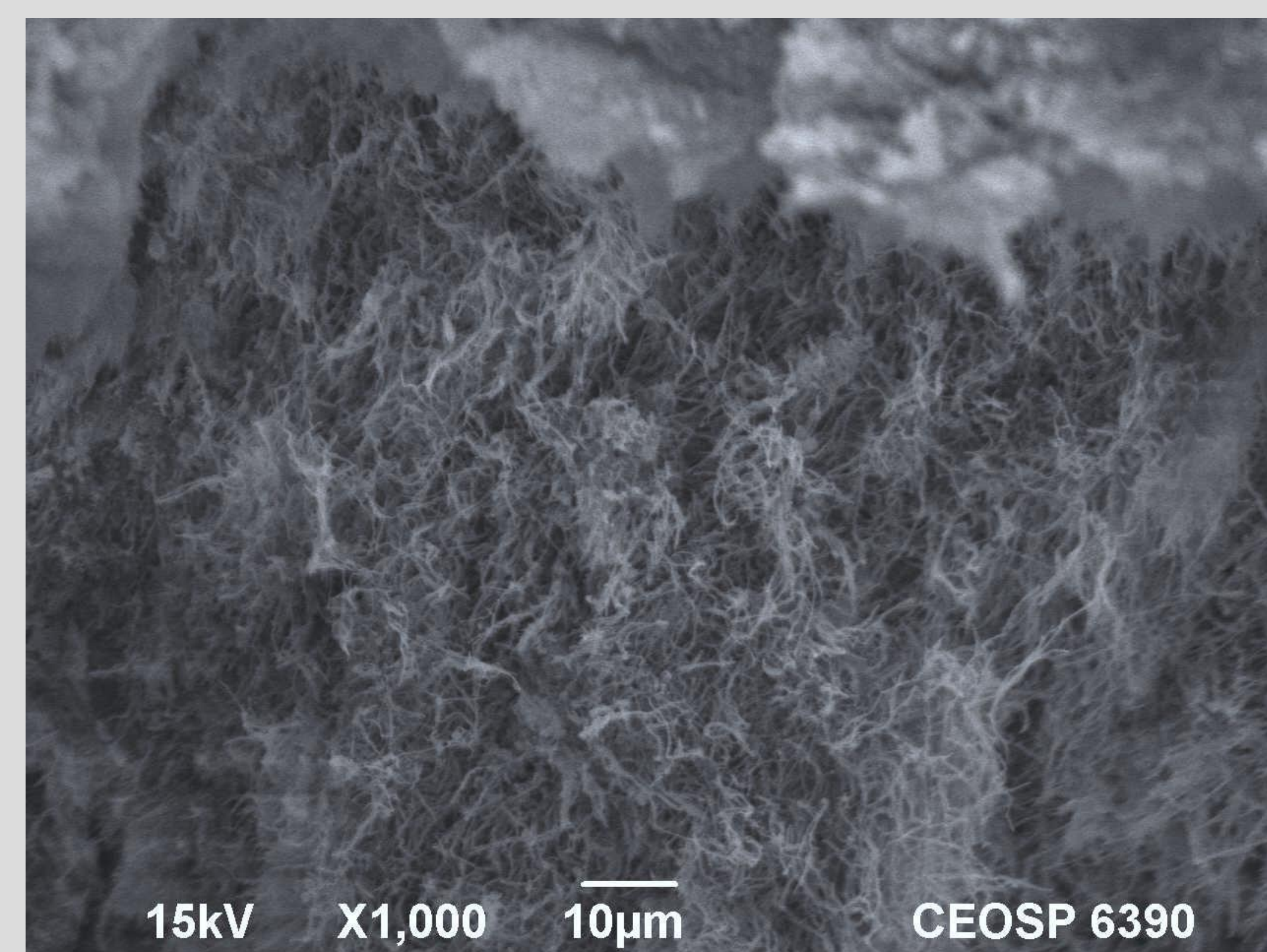
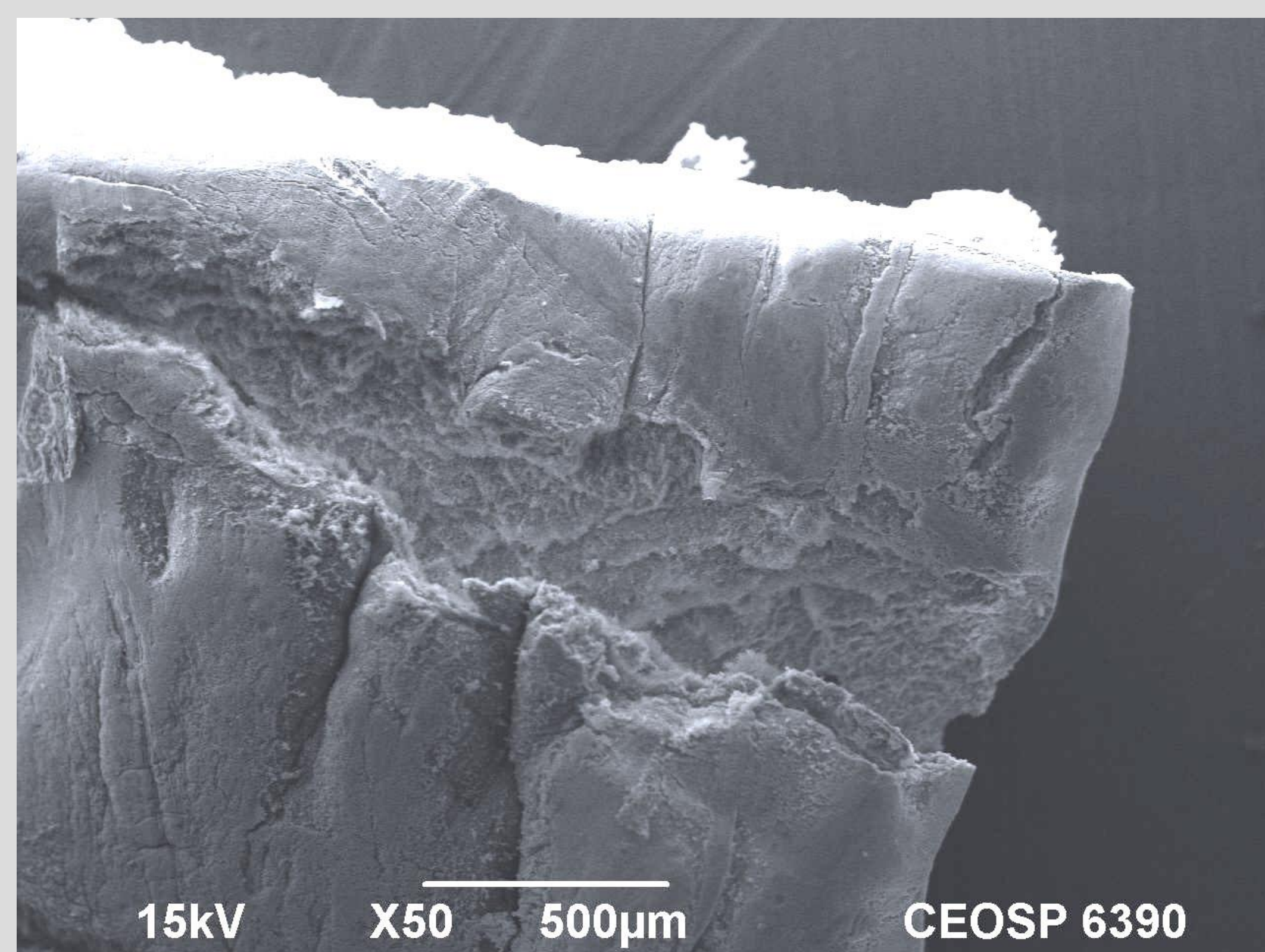
On the other hand, after waiting time (30 min) for using the membrane, showed a significant increase in resistance between F200 and F800 groups. Therefore, the membrane from F400 group showed no difference in resistance when compared to F200 and F800 with waiting time of 30 min.

Table 1: The values of the resistance force groups (mean±standard deviation)

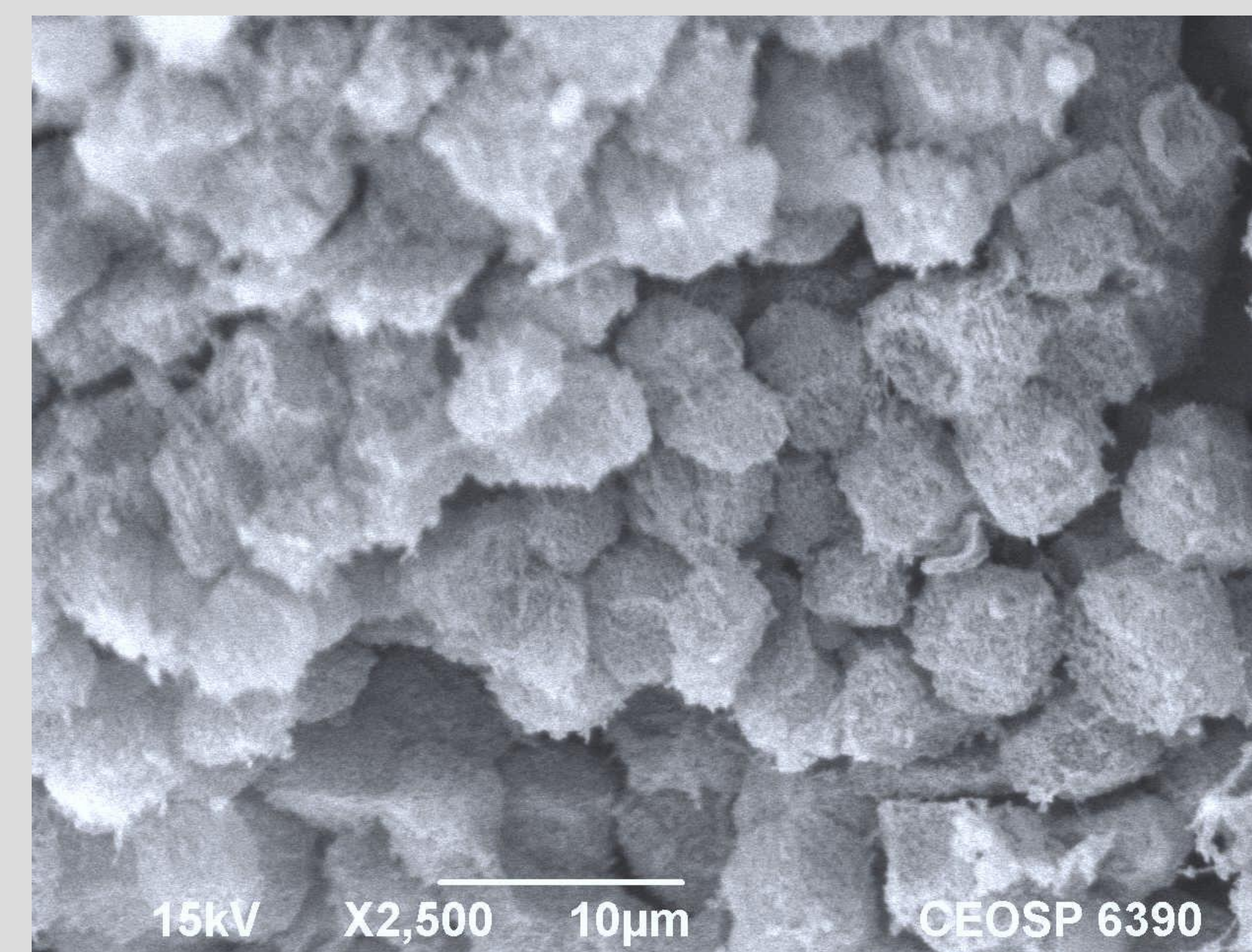
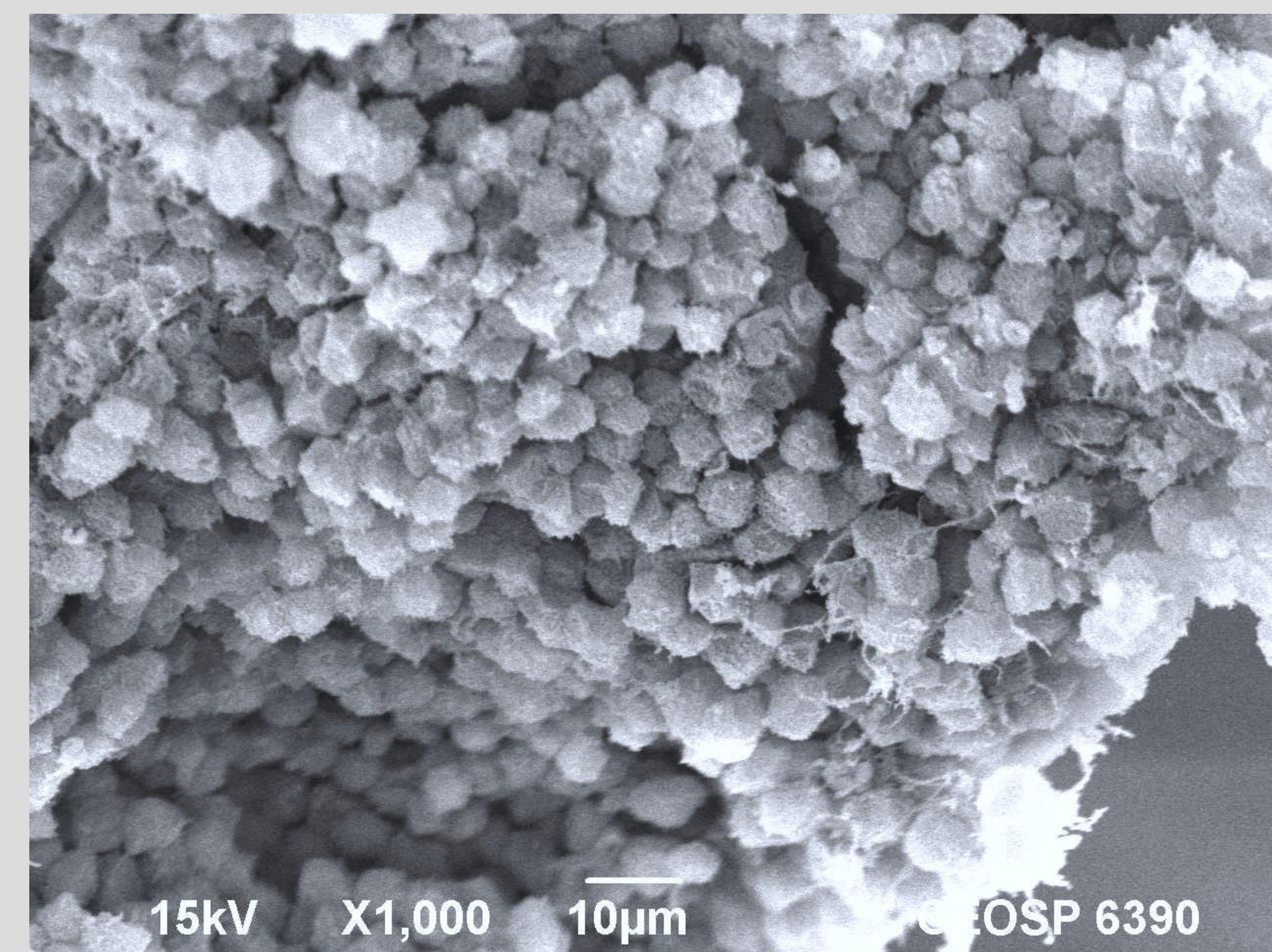
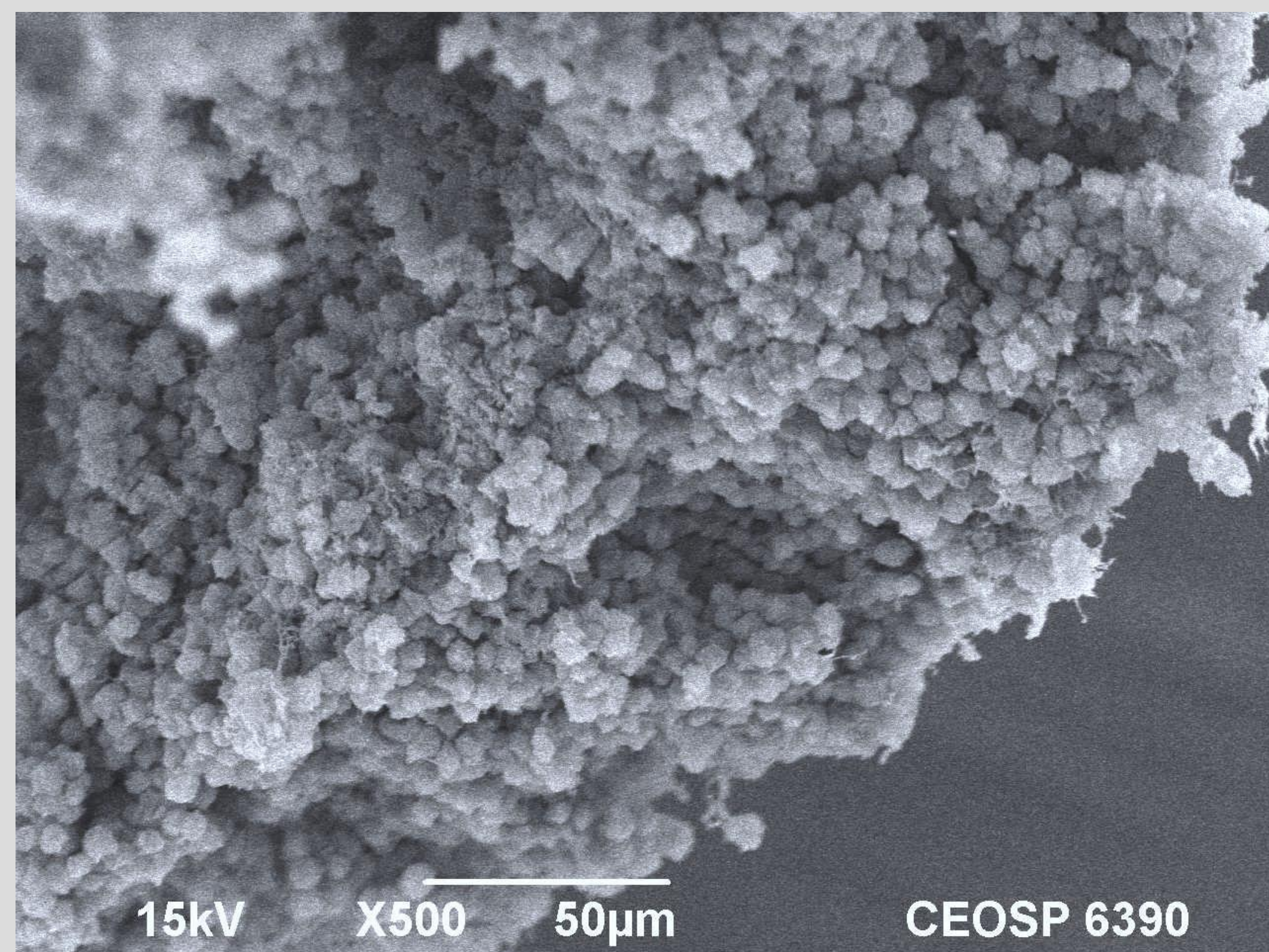
Groups	F200	F400	F800
T0	991.65±164.39	1.109.10±115.97	1.148.36±229.64
T30	996.39±225.06 ^a	1.130.43±297.27 ^{a, b}	1.313.91±64.97 ^b

Different lower case letters on the same line indicate significant differences with significance level of 5% (student's *t*-test). T0 – Immediate use (time); T30 – Use after 30 min (time); F200 – g-force of 200 m/s²; F400 – g-force of 400 m/s²; F800 – g-force of 800 m/s²

SCANNING ELECTRON MICROSCOPE



Leukocytes platelet-rich fibrin membrane after rupture with high magnification by Scanning Electron Microscope. (a) $\times 50$; (b) $\times 1000$; (c) $\times 2500$ *Note the fibrin network



Leukocytes platelet-rich fibrin membrane after rupture (specifically the buffy coat area) with high magnification by Scanning Electron Microscope. (a) $\times 50$; (b) $\times 1000$; (c) $\times 2500$

CONCLUSION

The greater the centrifugal force, the greater is the pulling force required to break the membrane.

The waiting time increased the degree of membrane resistance.

