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Exceptional thermal stability of therapeutical enzymes entrapped in alumina sol-gel matrices

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Electronic Supplementary Information

Additional characterization data of the alumina matrixes

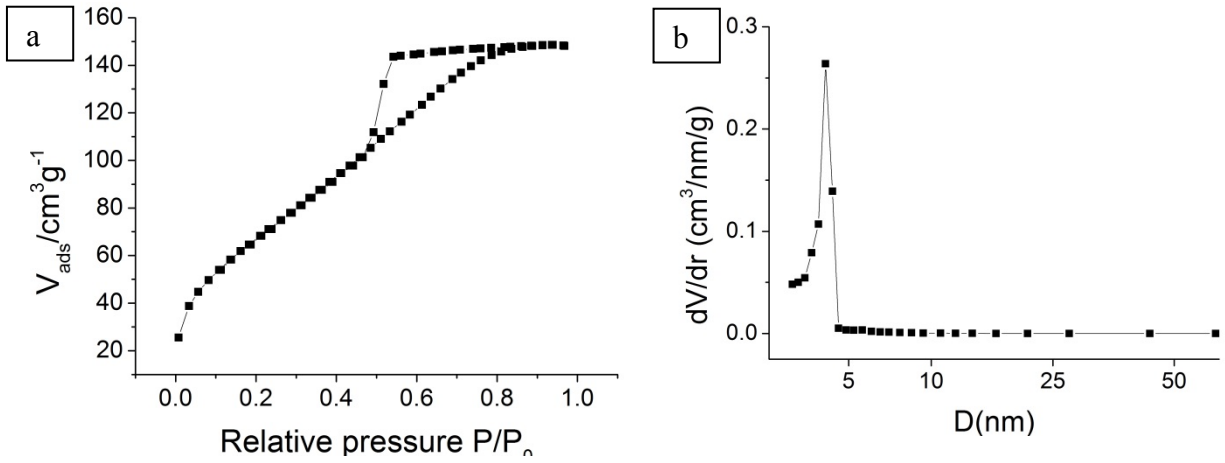

Figure 1S. N_2 adsorption–desorption isotherm (a), pore size distribution (b) of the sol – gel alumina prepared by the ultrasound method.

The dried matrix had a surface area of 153 m^2/g and pore volume of 0.097 cm^3/g. The sol – gel alumina prepared by the ultrasound method [1] displays the classical type IV isotherm with hysteresis loop that is typical of mesoporous material. The step in the adsorption isotherm curve at p/p_0 of 0.4 and 0.9 (Fig. 1Sa) suggests ink-bottle-type mesopores (Type D). Ultrasound treatment leads to the closely packed structure of alumina nanoparticles with average pore size 2.5 nm. The surface acidity of boehmite from isopropoxide is well-known [2].

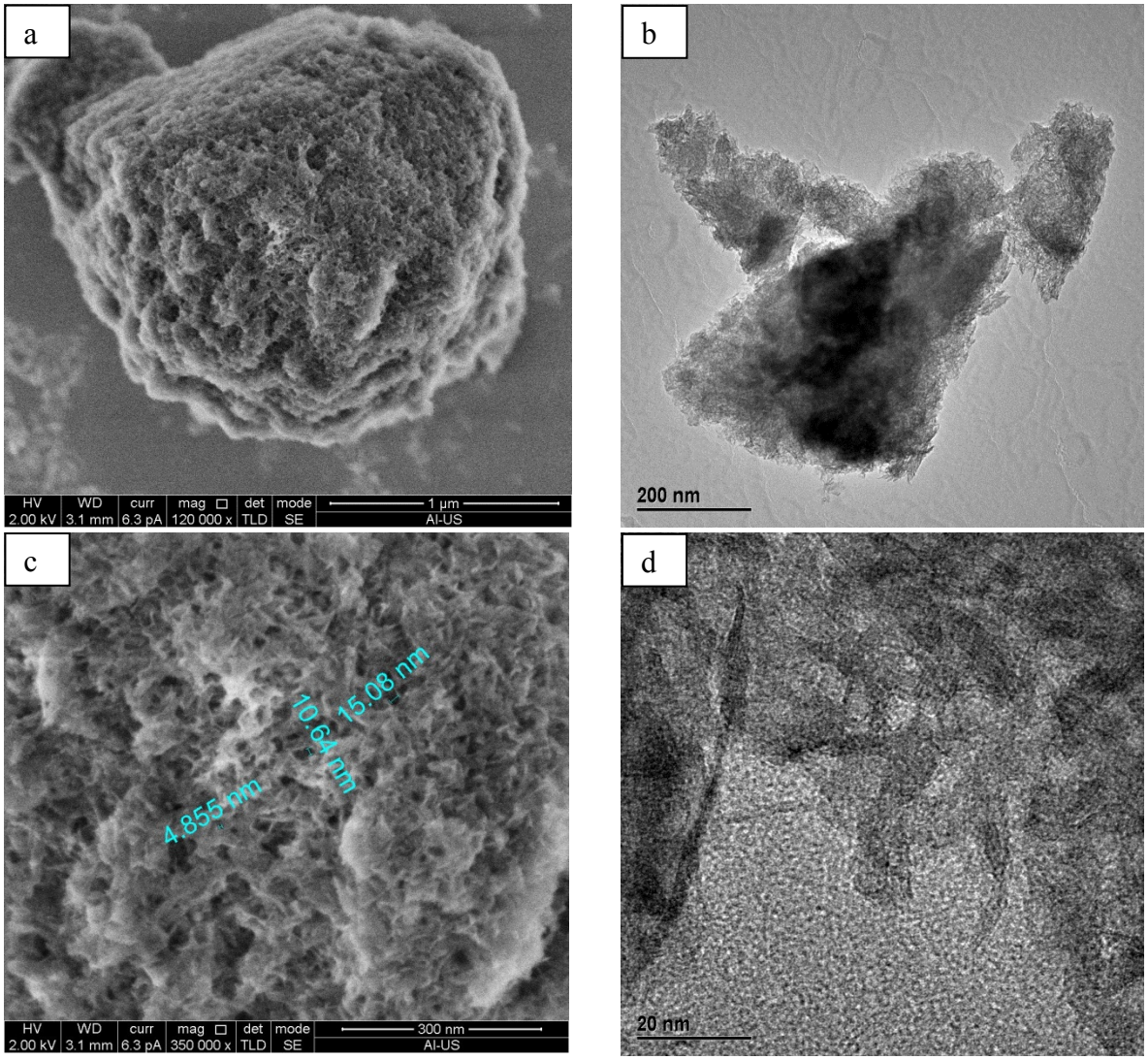

Figure 2S. SEM (a,c) and TEM (b,d) images of the alumina matrix at different magnifications.

The SEM and TEM (Fig.2S) pictures show that the obtained boehmite is composed of well-crystallized nanorods with an average size of 1 × 10 nm, which are arranged into a dense structure. The average size of the mesopores is about 3–4 nm, which agrees well with the data of the adsorption–desorption isotherm of nitrogen.

Characterization instrumentation: Specific surface areas, pore volumes and pore sizes distribution have been determined using the nitrogen adsorption-desorption method at 77 K (Micromeritics ASAP 2020). Surface areas were calculated using the BET equation. Pore volumes and pore size distributions were calculated using the BJH method. Before the analysis the sample was degassed for 6 hours at 50°C. For scanning electron microscopy (SEM, ultrahigh resolution Magellan 400L electron microscope), the final suspension of the entrapped enzyme was coated on silicon wafer and fully dried under vacuum. The samples for transmission electron microscopy (TEM) were obtained by dispersing small amounts of samples in ethanol until the formation of a homogeneous suspension. Then, a droplet of suspension was deposited onto a copper substrate coated with carbon for TEM analysis. (FEI TECNAI G2 F20, at a working voltage of 200 kV).

References for ESI:

1. A. Rutenberg, V. Vinogradov, D. Avnir, *Chem Commun,* 2013, **49**, 5636.
2. G. Busca, *Catal. Today,* 2013, http://dx.doi.org/10.1016/j.cattod.2013.08.003