Evaluation of Dysprosia Aerogels as Drug Delivery Systems: A Comparative Study with Random and Ordered Mesoporous Silicas

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Supporting Information

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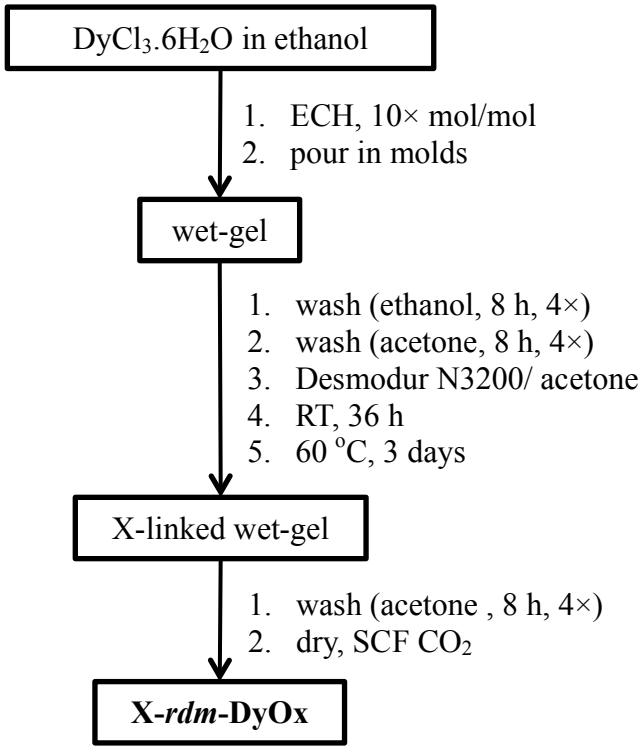
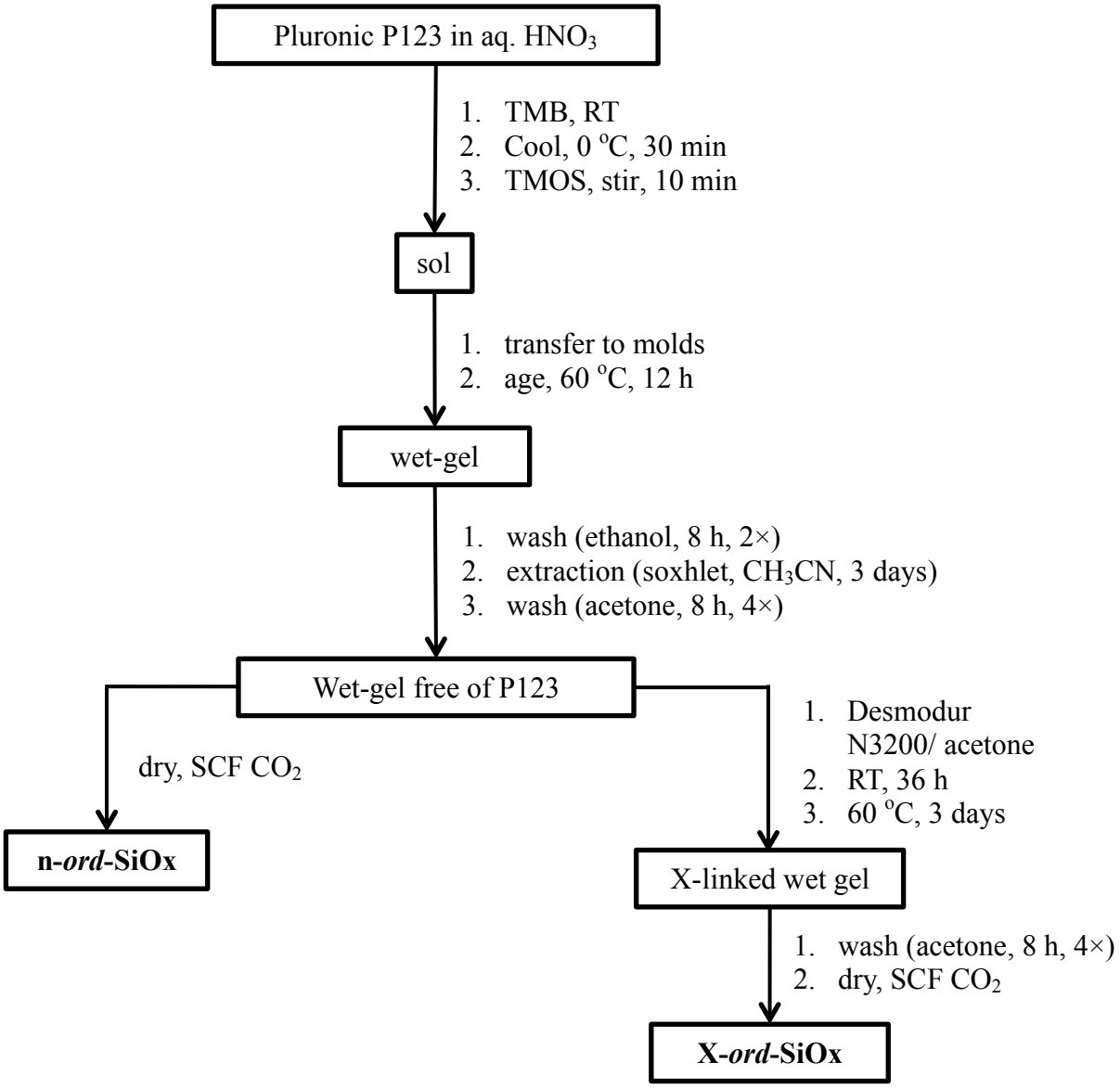
Appendix I. Flow charts for the aerogel synthetic protocols

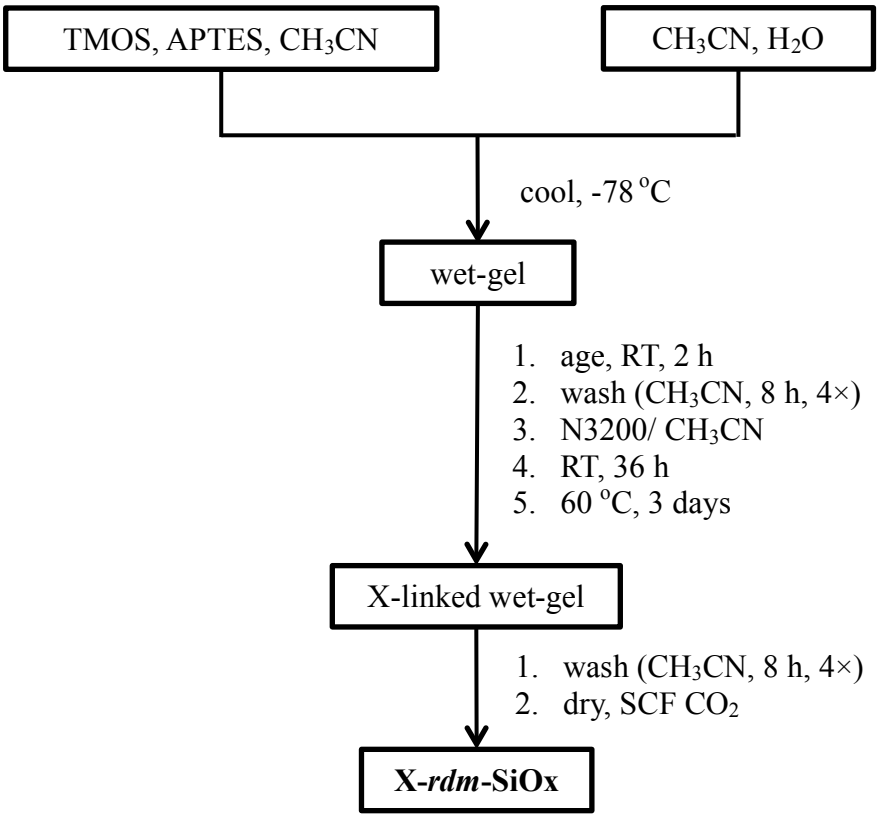
Scheme S.1. Synthesis of X-DyOx aerogels



Scheme S.2. Synthesis of n-*ord*-SiOx & X-*ord*-SiOx aerogels



Scheme S.3. Synthesis of X-*rdm*-SiOx aerogels



Appendix II. TGA data and the calculation method for the weight percent of drug loading

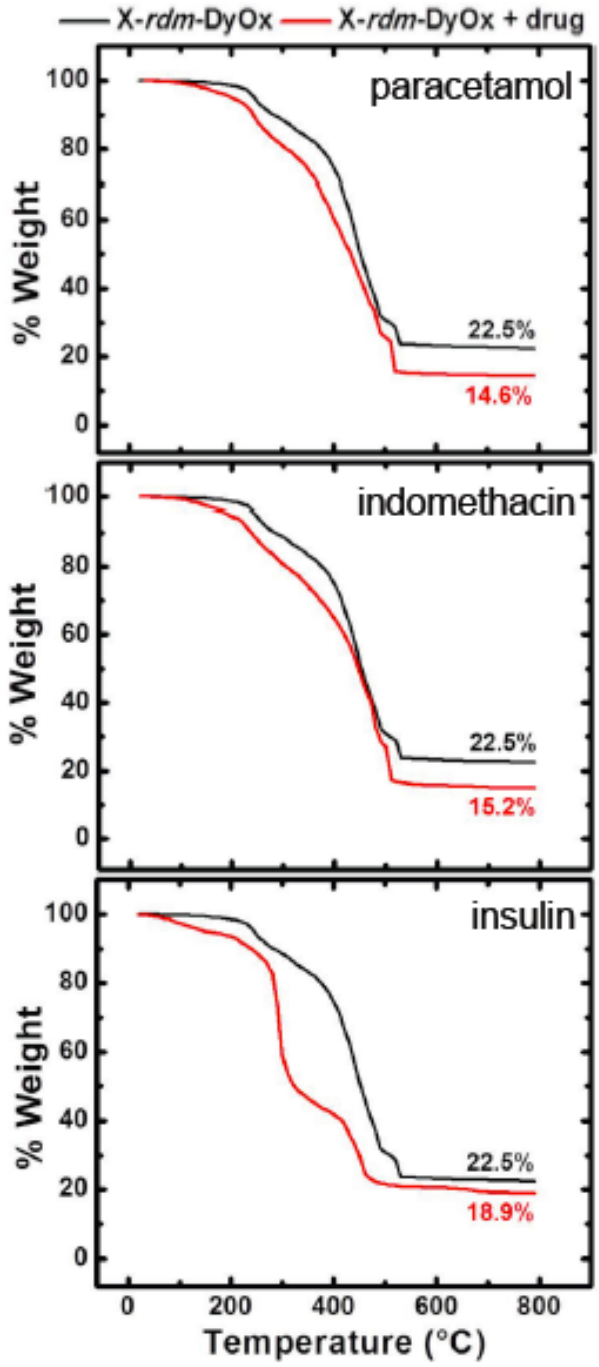


Figure S.1. Representative thermogravimetric analysis (TGA) data in air of samples as indicated. (Heating rate = 10 ^{o}C min^{-1}.)

Calculation of drug loading based on TGA data:

The mass (M) of cross-linked (X-) DyOx aerogels (M-X-*rdm*-DyOx) have two components: an inorganic one ($DyOx_{inorg}$) and a polymeric one ($DyOx_{poly}$);
Therefore,
M-X-*rdm*-DyOx = $DyOx_{inorg} + DyOx_{poly}$

For example, from the TGA data of X-*rdm*-DyOx that is later loaded with paracetamol (see Figure 5 in the main article) we get:
$DyOx_{inorg}$ =22.5%, therefore, $DyOx_{poly}$ = (100-22.5)% = 77.5% (1)
Therefore,
$DyOx_{poly}/DyOx_{inorg}$ = (77.5/22.5) = 3.44

Hence,
$DyOx_{poly} = 3.44 * DyOx_{inorg}$ (2)

Now, the mass of drug-loaded X-*rdm*-DyOx, M-[$(X\text{-}rdm\text{-}DyOx)_{drug}$], has three components: an inorganic component DyOx ($DyOx_{inorg}$), a polymeric component ($DyOx_{poly}$) and a drug component ($DyOx_{drug}$);

Therefore, M-[$(X\text{-}rdm\text{-}DyOx)_{drug}$] = $DyOx_{inorg} + DyOx_{poly} + DyOx_{drug}$ (3)

Introducing eq. 2 into eq. 3 yields:
M-[$(X\text{-}rdm\text{-}DyOx)_{drug}$] = $DyOx_{inorg}$ + (3.44* $DyOx_{inorg}$) + $DyOx_{drug}$ (4)

which is rearranged into:

$DyOx_{drug}$ = M-[$(X\text{-}rdm\text{-}DyOx)_{drug}$] - $DyOx_{inorg}$ - (3.44* $DyOx_{inorg}$) (5)

From the TGA data of the X-*rdm*-DyOx after loading with paracetamol (see Figure 5 of the main article), $DyOx_{inorg}$ = 14.46%;

Therefore, eq. 5 yields:

$DyOx_{drug}$ % = [100 – 14.46 - (3.44* 14.46)]% = 35.79% w/w.

Appendix III. Typical spectrophotometric data for drug release

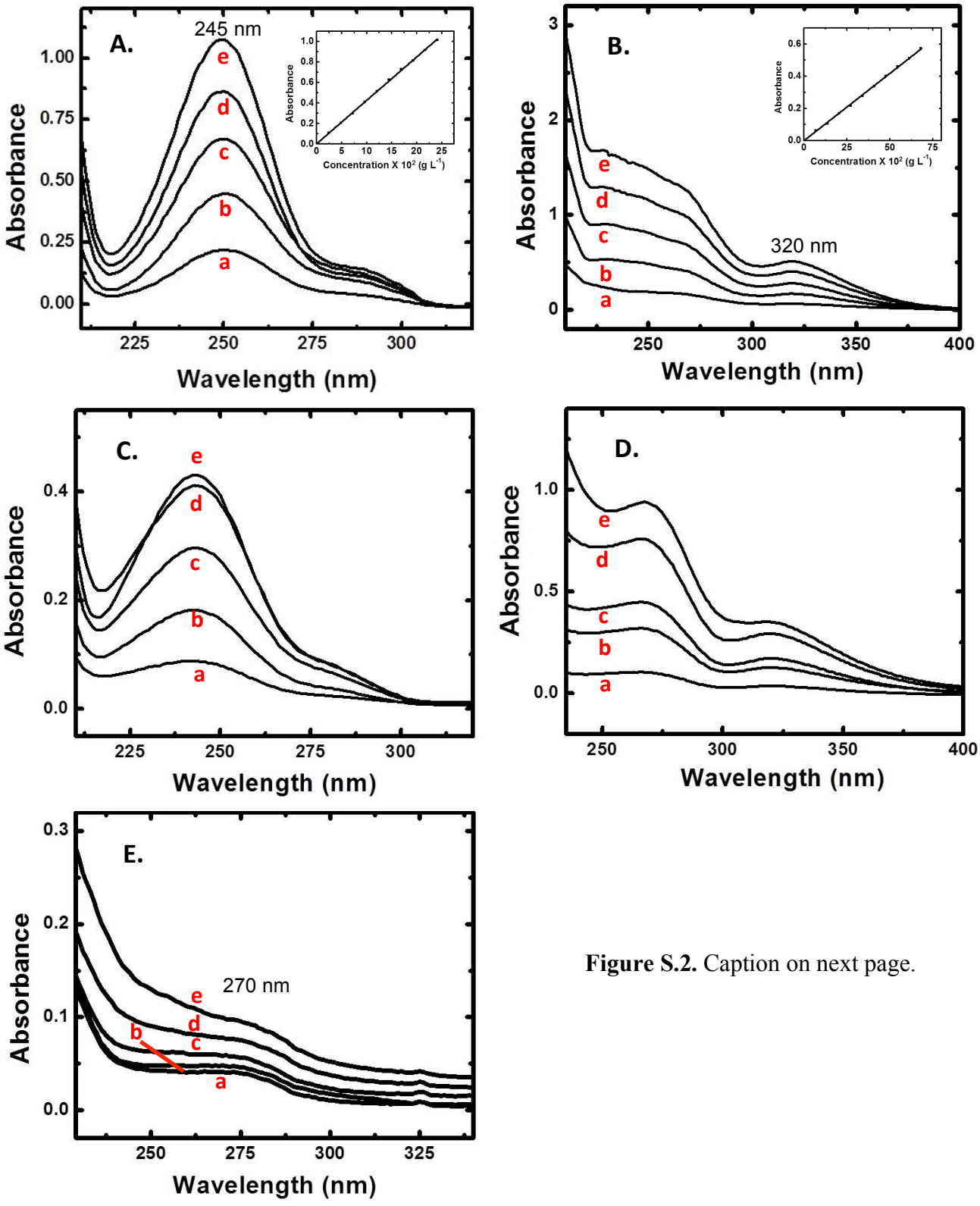


Figure S.2. Caption on next page.

Figure S.2. UV-Vis. absorption spectra at various concentrations of:
(A) Paracetamol: (a) 4.85 $\times 10^{-2}$ g L^{-1}, (b) 9.60 $\times 10^{-2}$ g L^{-1}, (c) 14.50 $\times 10^{-2}$ g L^{-1}, (d) 19.36 $\times 10^{-2}$ g L^{-1}, (e) 24.12 $\times 10^{-2}$ g L^{-1};
(B) Indomethacin: (a) 6.82 $\times 10^{-2}$ g L^{-1}; (b) 20.47 $\times 10^{-2}$ g L^{-1}; (c) 34.27 $\times 10^{-2}$ g L^{-1}; (d) 47.59 $\times 10^{-2}$ g L^{-1}; (e) 61.23 $\times 10^{-2}$ g L^{-1}
(Insets: calibration curves).

UV-Vis absorbance spectra of the drug release medium, as follows:
(C) Paracetamol released from X-*rdm*-DyOx aerogels in phosphate buffer (pH = 7.4) at: (a) 5 min, (b) 1 h; (c) 5 h; (d) 48 h; (e) 60 h;
(D) Indomethacin released from X-*rdm*-DyOx aerogels in phosphate buffer (pH = 7.4) at: (a) 5 min; (b) 1 h; (c) 5 h; (d) 24 h; (e) 72 h; and,
(E) Insulin released from X-*rdm*-DyOx aerogels in 0.1 N aqueous HCl at: (a) 5 min; (b) 15 min; (c) 5 h; (d) 28 h; (e) 60 h.