

# Design of TiO<sub>2</sub>-Surfactin hybrid systems with multifunctional properties

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**Table S1.** Sample codes and TiO<sub>2</sub>:SS weight ratios of nanosols obtained by sol-gel synthesis process and relative powders obtained by SFD process.

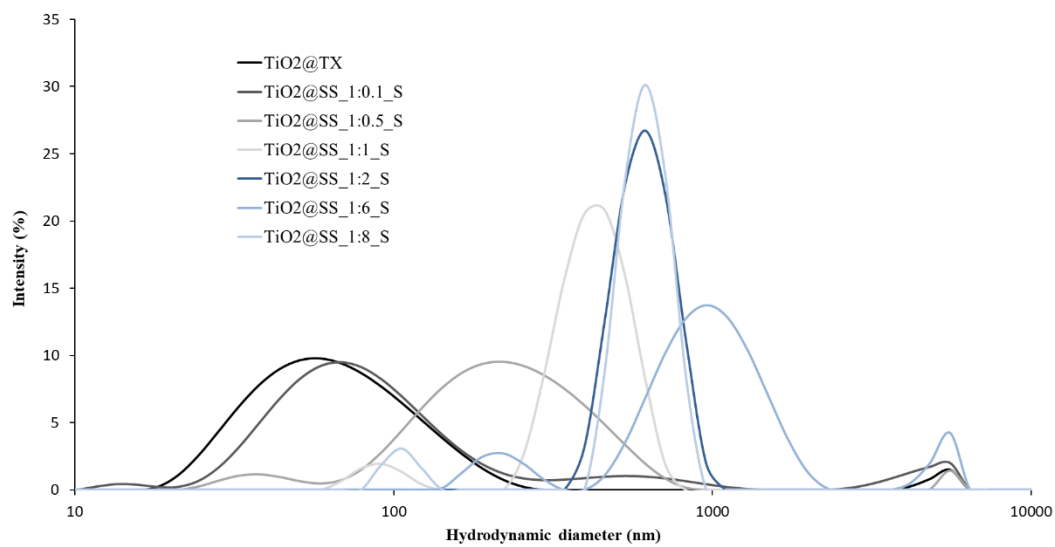
Sample code		TiO <sub>2</sub> :SS weight ratio
Nanosol	Powder	
TiO <sub>2</sub> @SS_1:0.1_S	TiO <sub>2</sub> @SS_1:0.1_S_SFD	10.0
TiO <sub>2</sub> @SS_1:0.5_S	TiO <sub>2</sub> @SS_1:0.5_S_SFD	2.0
TiO <sub>2</sub> @SS_1:1_S	TiO <sub>2</sub> @SS_1:1_S_SFD	1.0
TiO <sub>2</sub> @SS_1:2_S	TiO <sub>2</sub> @SS_1:2_S_SFD	0.5
TiO <sub>2</sub> @SS_1:6_S	TiO <sub>2</sub> @SS_1:6_S_SFD	0.17
TiO <sub>2</sub> @SS_1:8_S	TiO <sub>2</sub> @SS_1:8_S_SFD	0.13
TiO <sub>2</sub> @TX_S	TiO <sub>2</sub> @TX_S_SFD	16.7*

\*TiO<sub>2</sub>:Triton X weight ratio

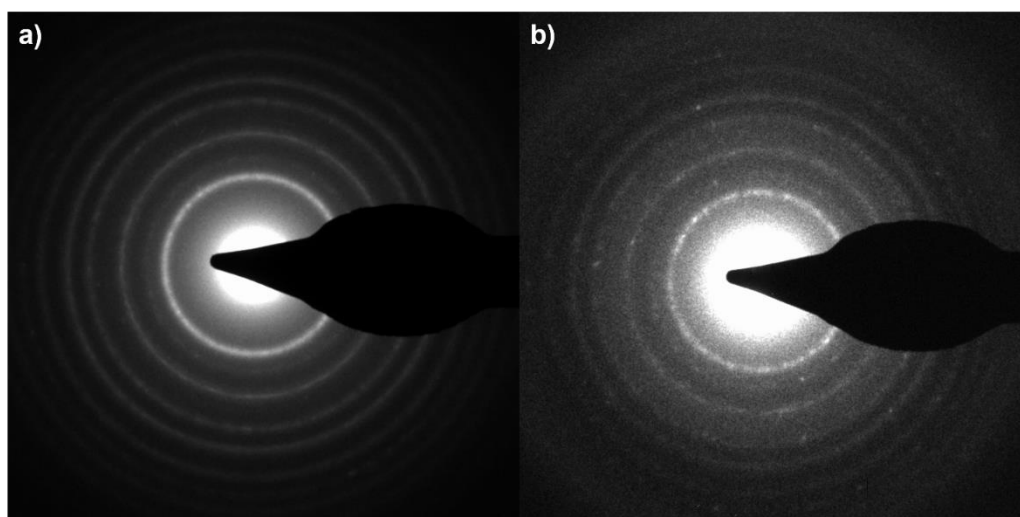
**Table S2.** Sample codes and TiO<sub>2</sub>:SS weight ratios of nanosols obtained by heterocoagulation process and relative powders obtained by SFD process.

Sample code		TiO <sub>2</sub> :SS weight ratio
Nanosol sample	Powder sample	
TiO <sub>2</sub> /SS_1:1_E	TiO <sub>2</sub> /SS_1:1_E_SFD	1.0
TiO <sub>2</sub> /SS_1:6_E	TiO <sub>2</sub> /SS_1:6_E_SFD	0.17
TiO <sub>2</sub> /SS_1:8_E	TiO <sub>2</sub> /SS_1:8_E_SFD	0.13

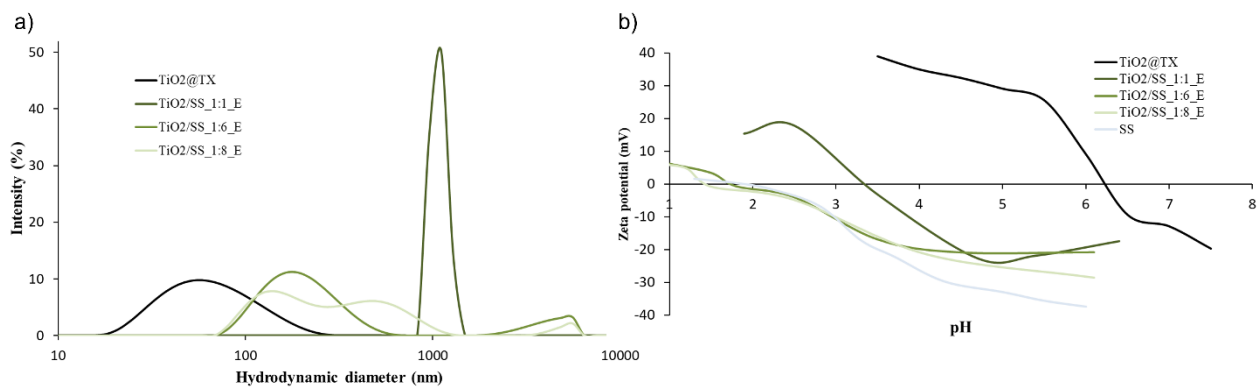
The TiO<sub>2</sub> used to produce the heterocoagulated samples is TiO<sub>2</sub>@TX of Table S1 (containing around 6 wt.% of Triton X)



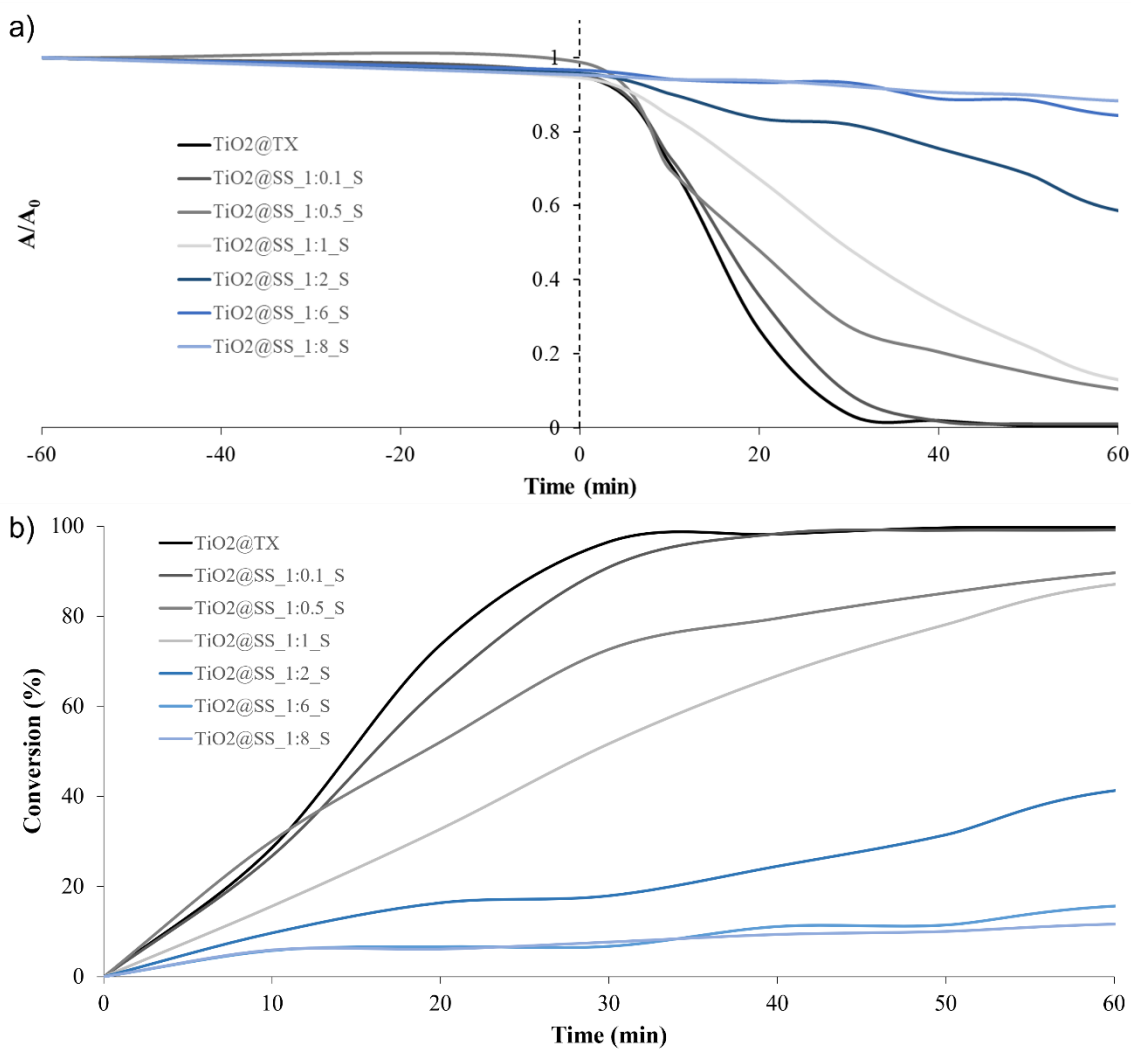
**Figure S1.** Particle size distribution of  $\text{TiO}_2@SS$  samples obtained by sol-gel synthesis method.



**Figure S2.** SAED patterns of a)  $\text{TiO}_2@SS_{1:0.1}$  and b)  $\text{TiO}_2@SS_{1:1}$  sample.



**Figure S3.** a) Particle size distribution and b) Zeta potential as a function of pH curves of TiO<sub>2</sub>/SS\_E samples obtained by heterocoagulation process.



**Figure S4.** a) Trend of A/A<sub>0</sub> and b) Conversion (%) over time of TiO<sub>2</sub>@SS\_S samples obtained by sol-gel synthesis method.

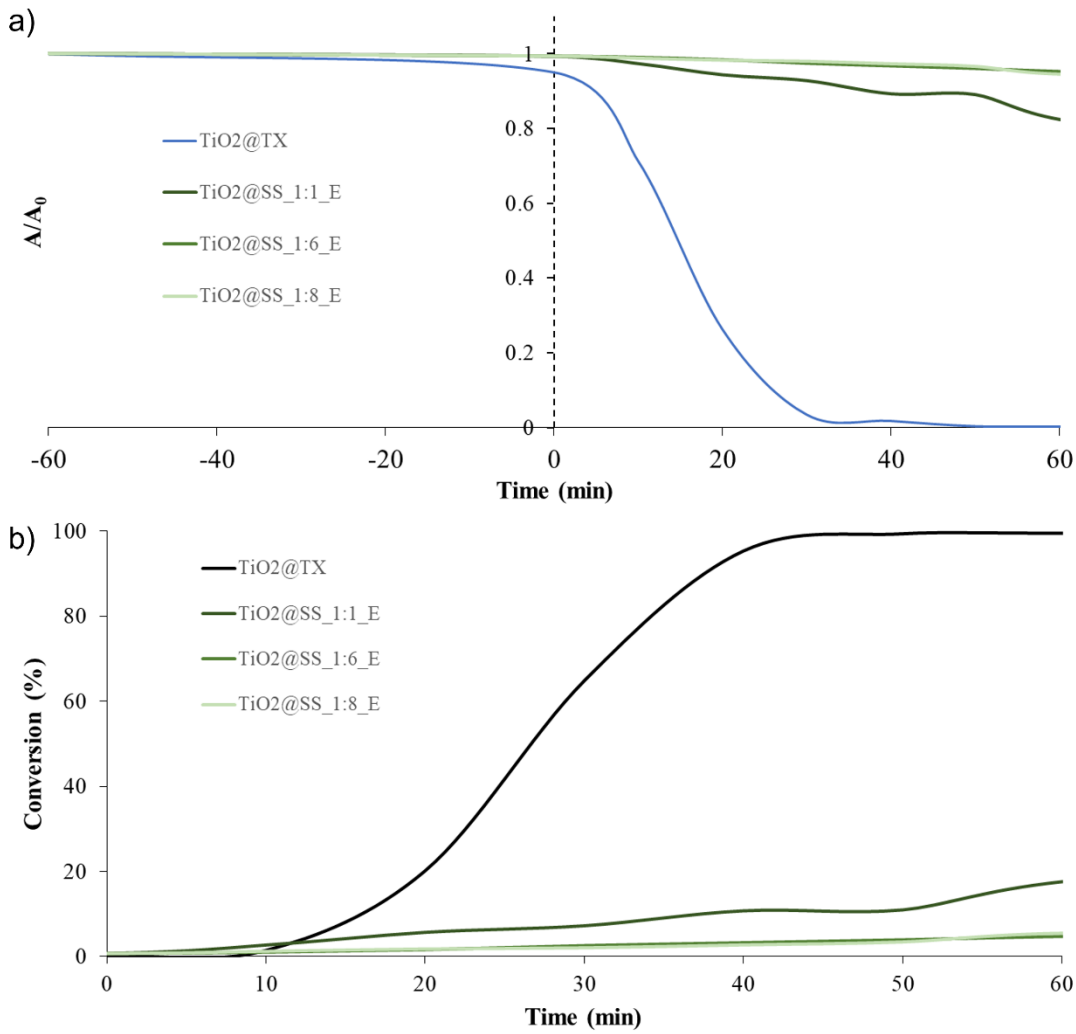


Figure S5. a) Trend of A/A<sub>0</sub> and b) Conversion (%) over time of TiO<sub>2</sub>/SS<sub>E</sub> samples obtained by heterocoagulation process.

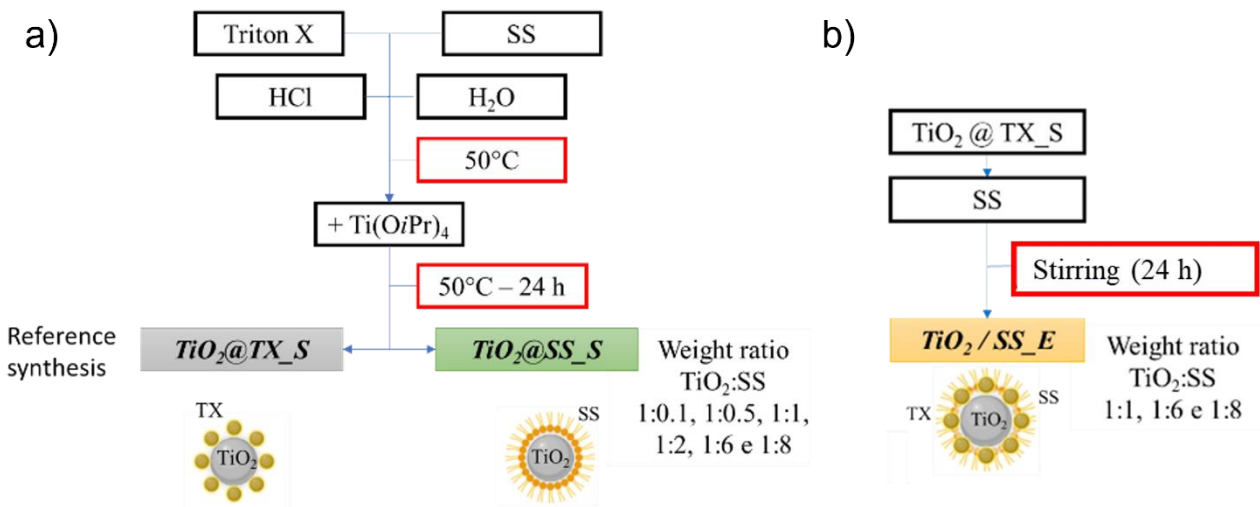


Figure S6. Scheme of a) sol-gel processes using Triton X (TX) and Sodium Surfactin (SS) as surfactant and b) heterocoagulation process.

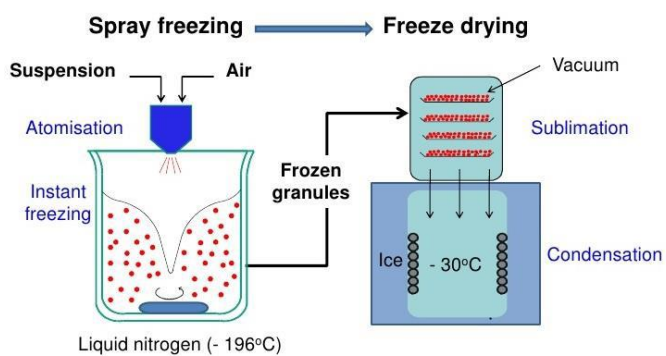


Figure S7. Schematisation of the spray-freeze-drying process.

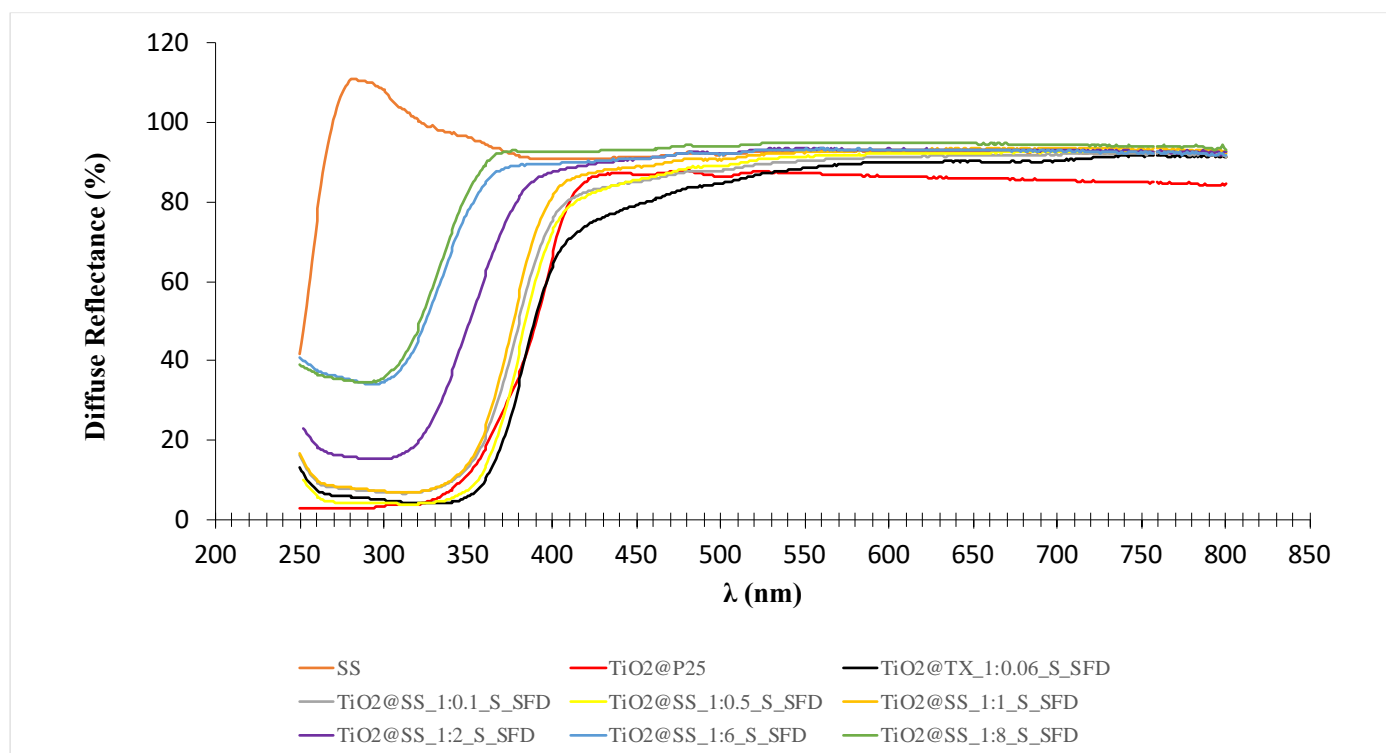


Figure S8. Diffuse reflectance over different wavelengths of TiO<sub>2</sub>@SS<sub>S</sub> samples.

**Table S3.** Adsorption properties derived by UV-Vis. analysis.

<b>Powder sample code</b>	<b>Absorption range (nm)</b>	<b>Band gap energy (eV)</b>
<b>TiO<sub>2</sub>@TX_SFD</b>	350-450	3.14
<b>TiO<sub>2</sub> P25*</b>	350-420	3.19
<b>TiO<sub>2</sub>@SS_1:0.1_S_SFD</b>	350-420	3.17
<b>TiO<sub>2</sub>@SS_1:0.5_S_SFD</b>	350-420	3.18
<b>TiO<sub>2</sub>@SS_1:1_S_SFD</b>	350-420	3.18
<b>TiO<sub>2</sub>@SS_1:2_S_SFD</b>	300-380	3.33
<b>TiO<sub>2</sub>@SS_1:6_S_SFD</b>	300-360	3.41
<b>TiO<sub>2</sub>@SS_1:8_S_SFD</b>	300-360	3.41

\*TiO<sub>2</sub> P25 (commercial powder sample from Degussa-Evonik)