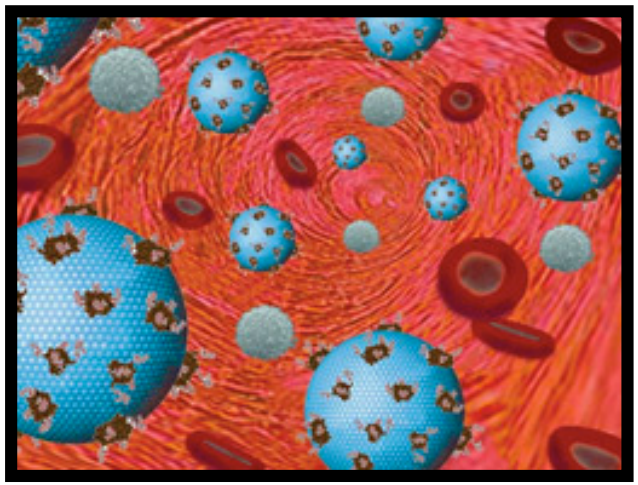
Synthesis of Nitric Oxide-Releasing Silica Nanoparticles



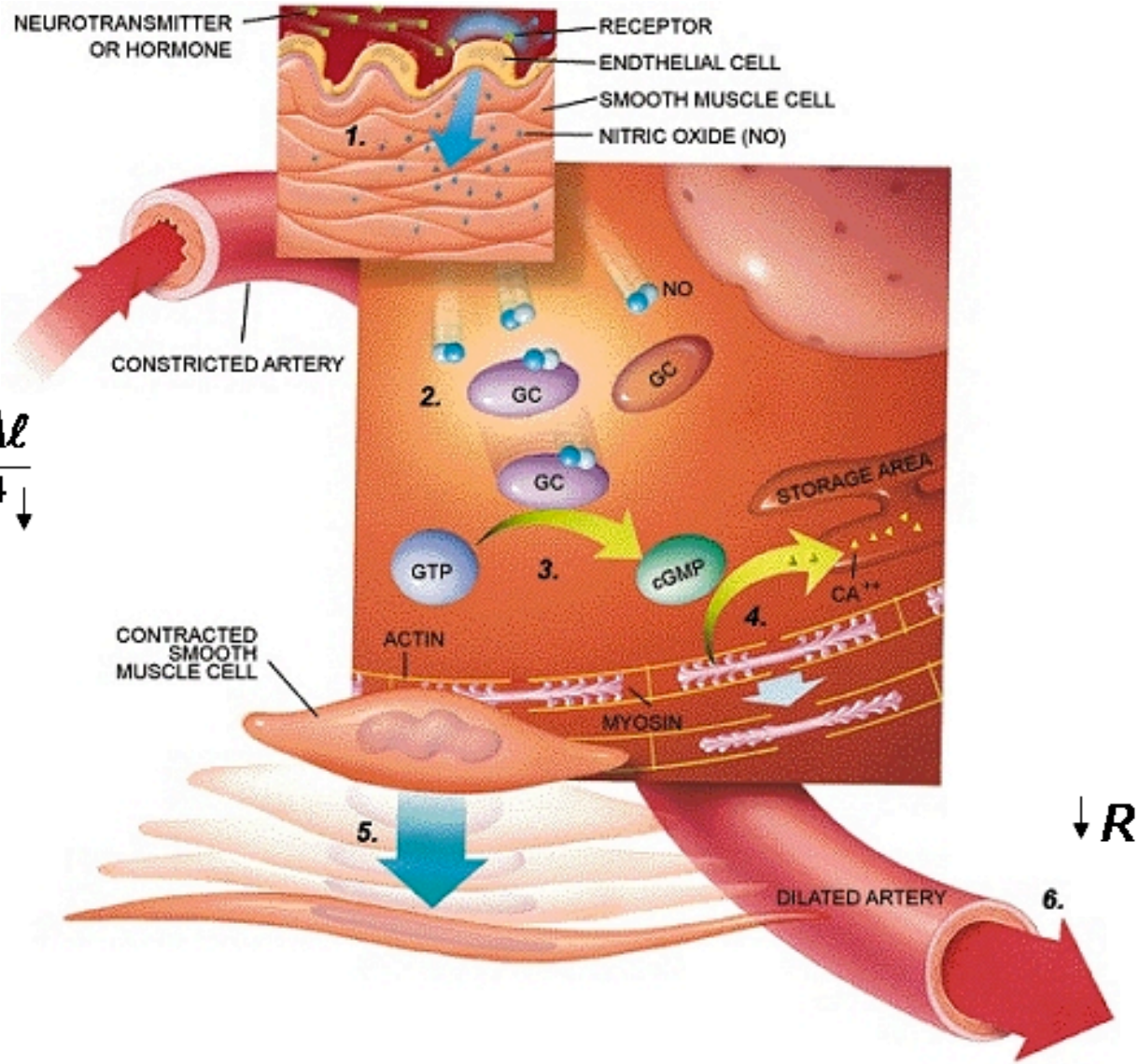
Amir H. Faraji

June 16, 2007

Schedule of Topics

- Biological Uses of Nitric Oxide
- Nitric Oxide Donors
- Nanoparticle Synthesis
- Nanoparticle Characterization
- Nanoparticle Properties

Nitric Oxide in Biology

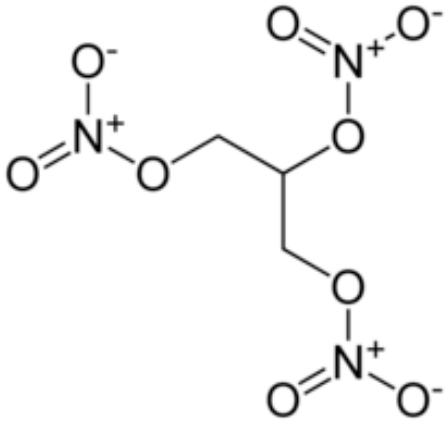


$$\uparrow R = \frac{8\eta\Delta\ell}{\pi r^{4}\downarrow}$$

$$\downarrow R = \frac{8\eta\Delta\ell}{\pi r^{4}\uparrow}$$

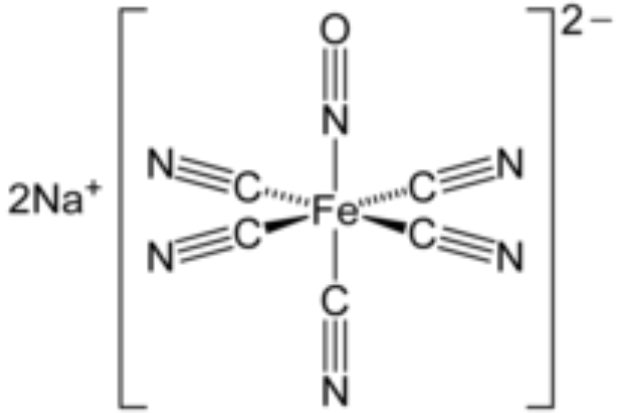
Image From: http://biomed.brown.edu/Courses/BI108/BI108_2000_Groups/Blood_Substitutes/nomech.html

Nitric Oxide Therapies



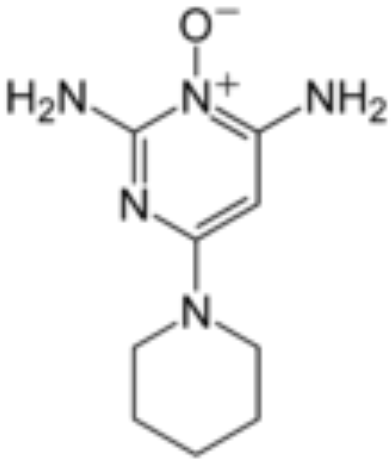
Nitroglycerin

$t_{1/2}$ = 3 min



Nitroprusside

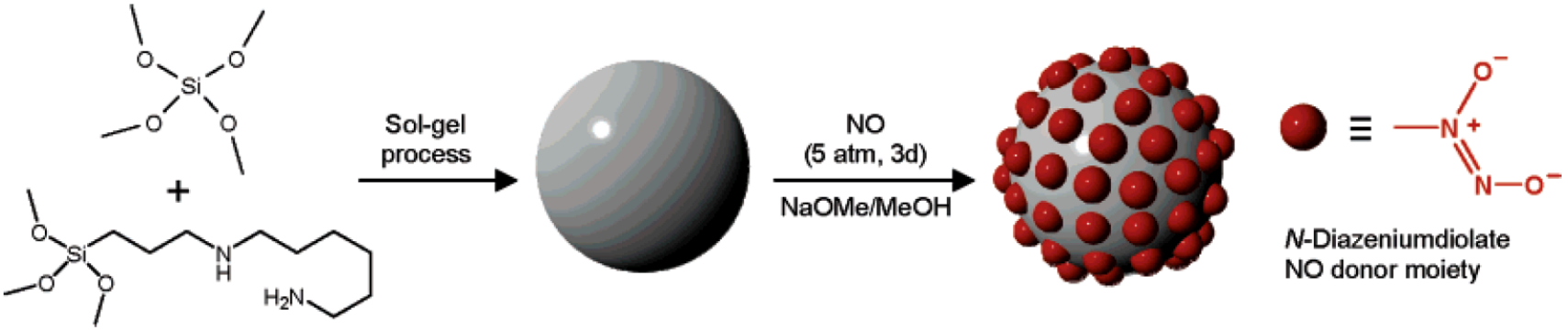
$t_{1/2}$ = 2 min

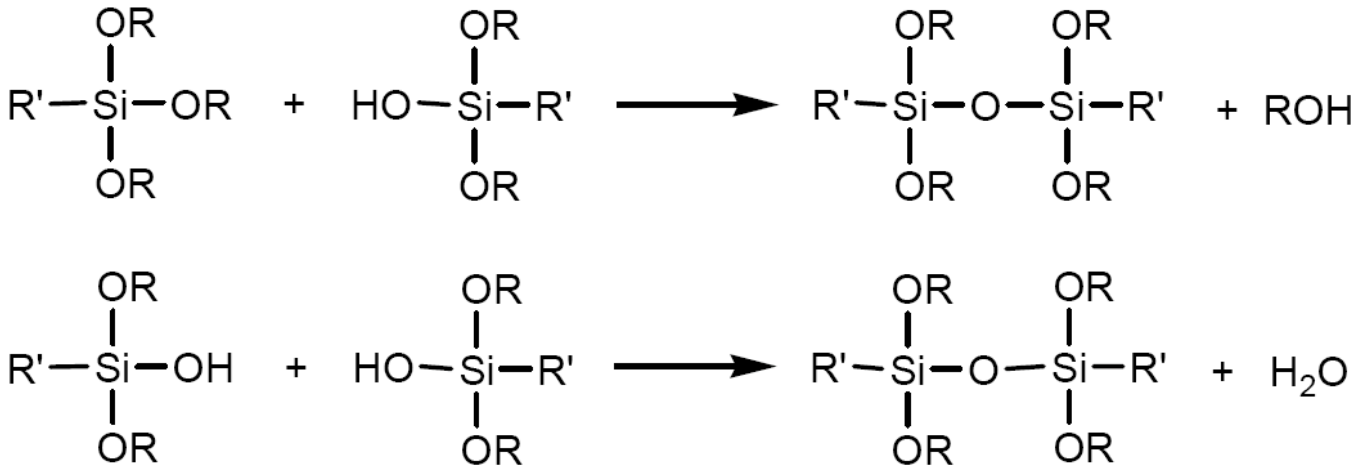


Minoxidil

$t_{1/2}$ = 4 h

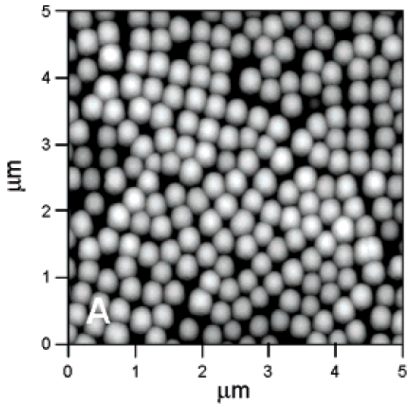
Nanoparticle Synthesis



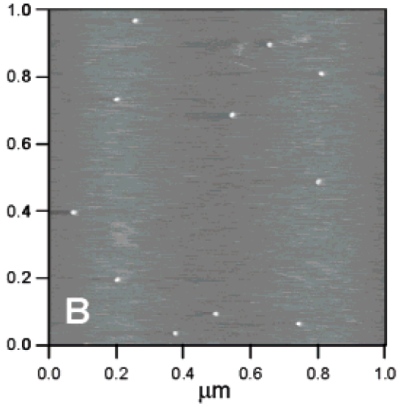


Sizing Nanoparticles With AFM

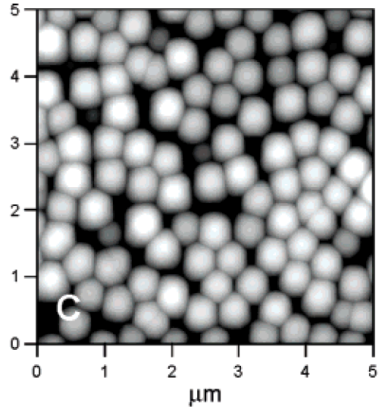
TEOS
250 ± 20 nm

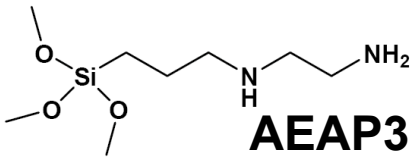


10 mol % AHAP3
20 ± 2 nm

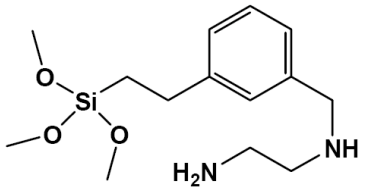


10 mol % AEAP3
500 ± 45 nm

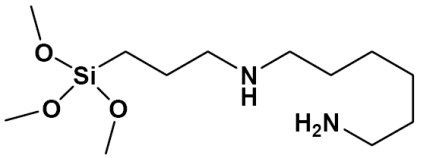




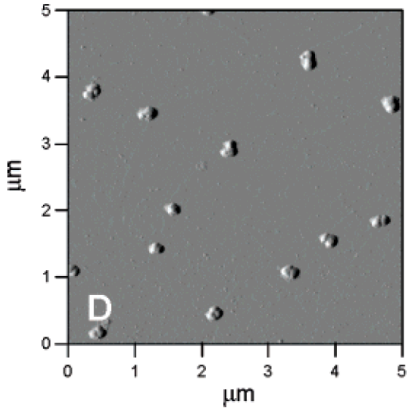
AEAP3

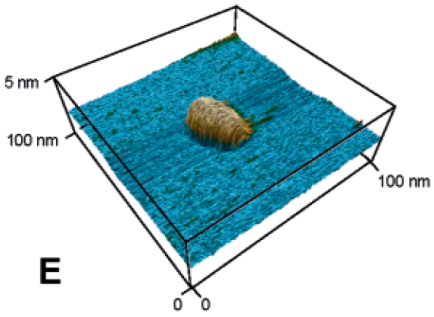


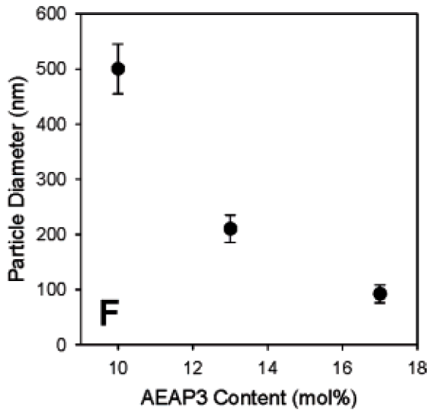
AEMP3



AHAP3

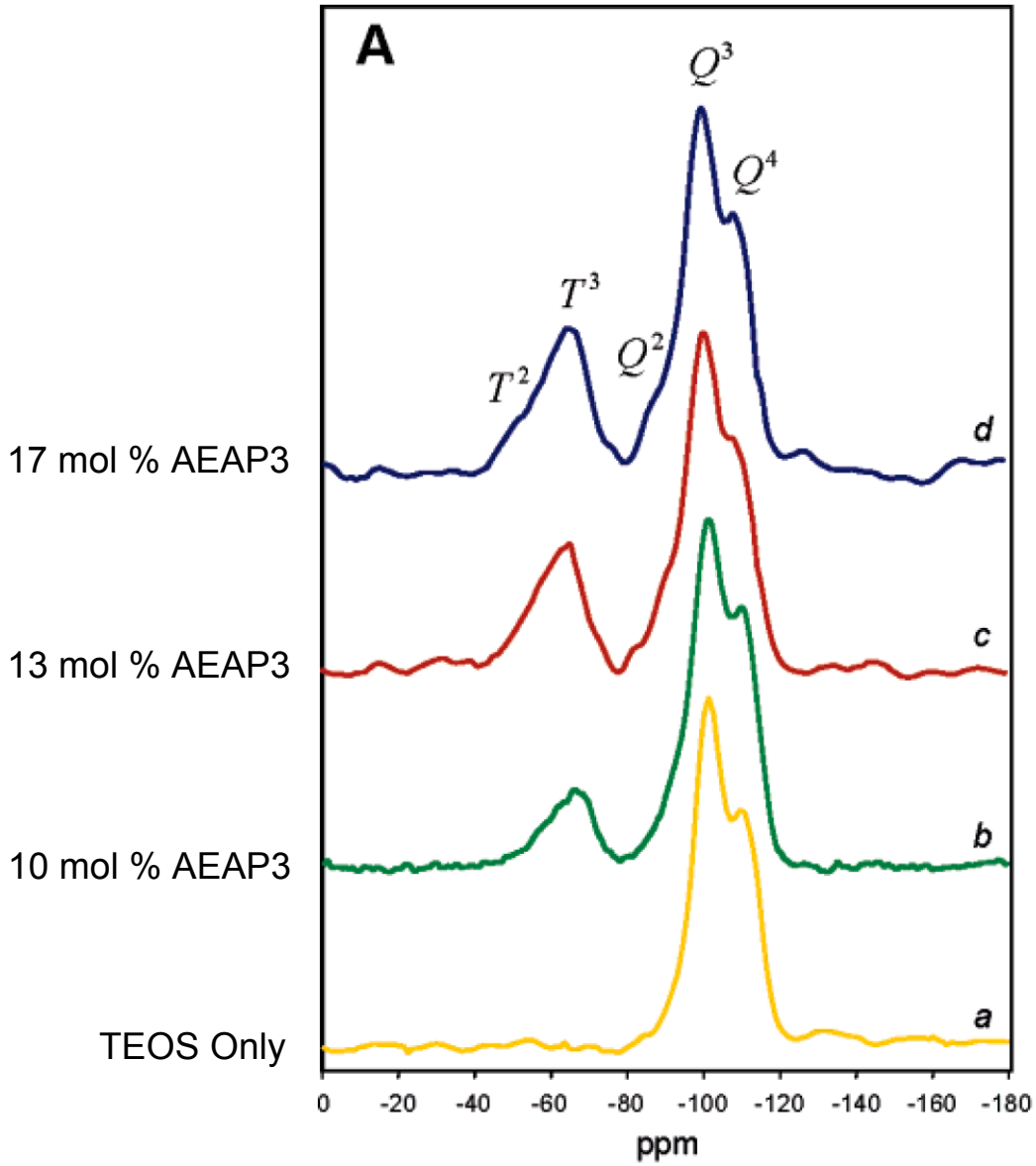


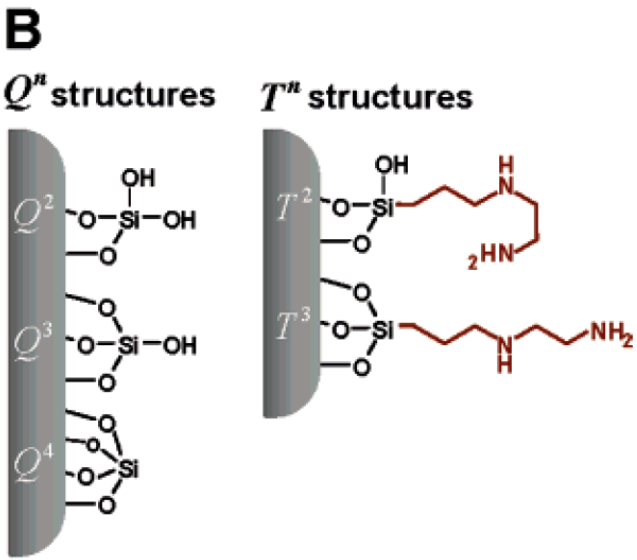


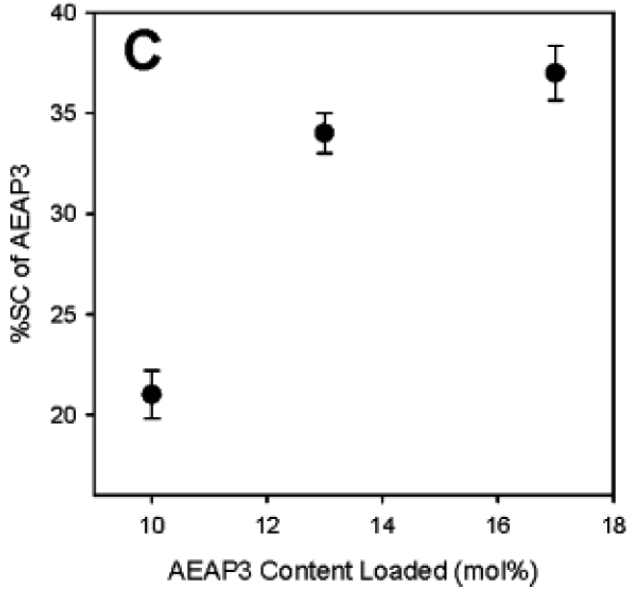


17 mol % AEAP3
92 ± 16 nm

MAS ^{29}Si NMR Characterization







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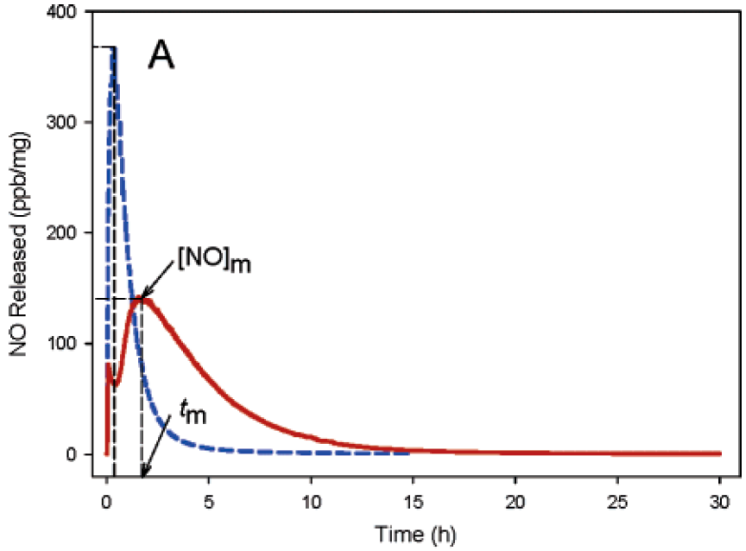
Nitric Oxide-Release Properties

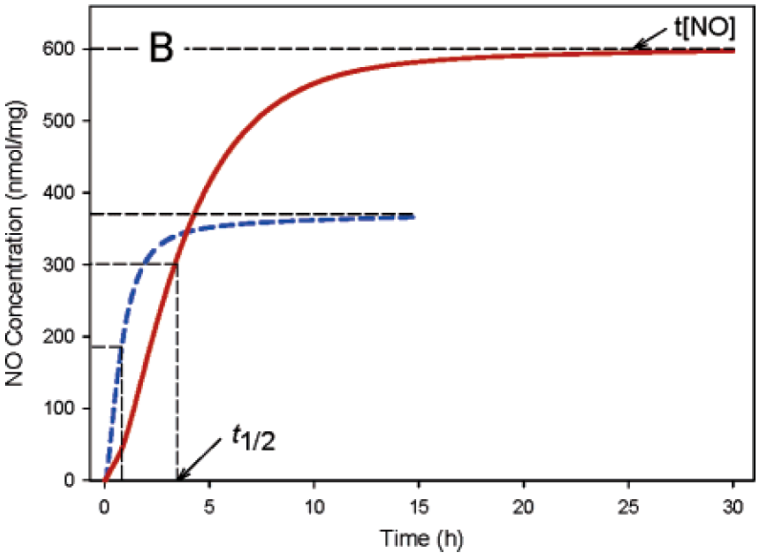
10 mol % AHAP3

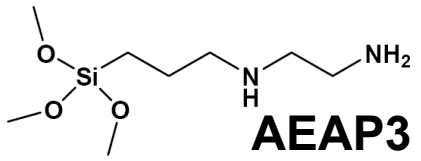
Size	20 ± 2 nm
$[NO]_m$	370 ± 10 ppb/mg
t_m	0.35 ± 0.05 h
t[NO]	380 ± 20 nmol/mg
$t_{1/2}$	0.9 ± 0.1 h

17 mol % AEAP3

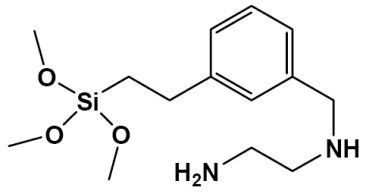
Size	92 ± 16 nm
$[NO]_m$	140 ± 10 ppb/mg
t_m	2.1 ± 0.3 h
t[NO]	600 ± 25 nmol/mg
$t_{1/2}$	3.4 ± 0.4 h



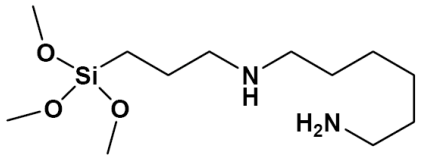




AEAP3



AEMP3



AHAP3

- - - 10 mol % AHAP3

—— 17 mol % AEAP3