ADVANCED CHARACTERIZATION OF POROUS DRUG NANOCARRIERS BY MEASURING THE WETTED SURFACE AREA

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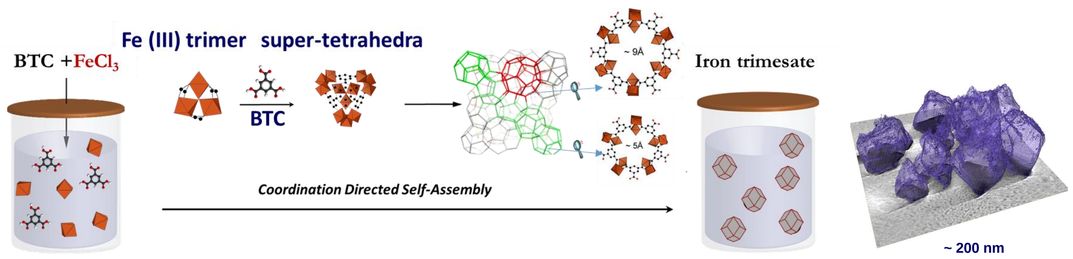
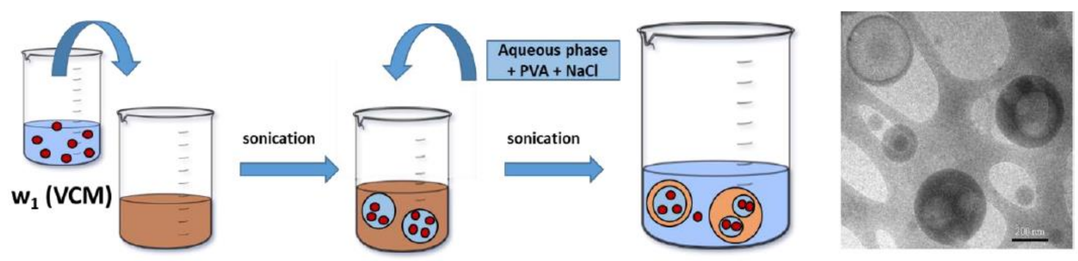
Metal Organic Frameworks (MOFs)



- ✓ Biodegradable materials
- ✓ High drug loading capacity
- ✓ Large pores (25 and 29 Å)
- ✓ High Surface Area (≈2000m^2/g)
- ✓ ''Green'' synthesis
- ✓ Possibility of surface modification with (oligo)or polysaccharides, PEG etc.
- ✓ Controlled drug release

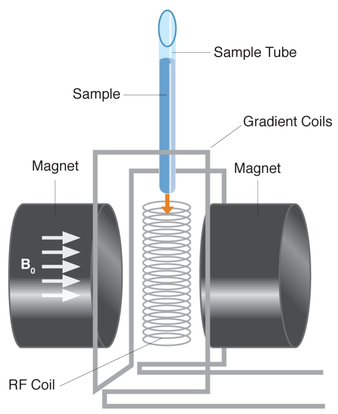
Polymeric (PLGA) Nanoparticles



- ✓ Simple preparation method
- ✓ Controlled size (300-320 nm); PDI ≈ 0.2
- ✓ High drug loading (≈15% weight)
- ✓ Biocompatible
- ✓ Stable upon storage
- ✓ pH triggered drug release

Acorn Area

The Acorn Area method allows the **study of the particle-liquid interface** using NMR relaxation since the liquid on the particle surface relaxes orders of magnitude faster than bulk liquid.



- ✓ Low sample volume required
- ✓ Fast and easy to use
- ✓ No need of drying samples
- ✓ Non-destructive method
- ✓ In porous particles, intraparticle liquid is prevented from exchange with the bulk liquid, and a second relaxation time associated to this phenomena is detected.
- ✓ Any surface active species such as a drug, polymer, or surfactant alters the exchange between the surface and bulk liquid domains, reducing the dispersion relaxation time.

Effect of drug/coating loading

RESULTS & DISCUSSION

Sample	Bi Fit T2A* (ms)	Bi Fit T2B** (ms)	[Particle] (mg/ml)	Solvent	Size (nm)
MOF	97.3	62.7	4	water	200
MOF@Drug	144.2		4	water	200
MOF@Coated CD	162.2		4	water	200
MOF (half degraded)	99.4	56.1	4	PBS	200
MOF (totally degraded)	151.1	37.1	4	PBS	200
PLGA	1409		16	water	320
PLGA-Drug	1252		16	water	320

*T2A extraparticle liquid relaxation time **T2B intraparticle liquid relaxation time

- ➢ MOFs shows 2 different relaxation times in agreement with their high porous structures.
- ➢ After drug loading and surface coating with cyclodextrins (CDs), the second component of the relaxation time disappear, clearly showing that the pores were filled with the drug and that the surface was efficiently coated.
- ➢ During MOF degradation (release of the organic ligand in PBS buffer), second component of the relaxation times progressively decreases suggesting that the particles became less and less porous.
- ➢ Regarding the PLGA particles, the monoexponential decay of the relaxation time indicates that the pores inside the particles are closed (no possible exchange with the outer media).
- ➢ The change in the relaxation time between the loaded and unloaded particles suggest that part of the drug was physically adsorbed onto the particles' surface.

CONCLUSIONS

- ➢ Acorn Area has proved to be a powerful tool to study the effect of drug incorporation and surface modification upon the porosity of the particles.
- ➢ The MOFs drug loading and CD coating was effective since the porosity was lost, implying the pores were filled with the drug and that the surface was totally covered with CDs.
- ➢ The kinetics of MOFs degradation was investigated showing a progressive porosity decrease.
- ➢ PLGA water inclusions were closed into the particles and part of the drug associated to the particles was located at their surfaces.