Increasing Bioavailability of an Antioxidant Through Nanotechnological Approach

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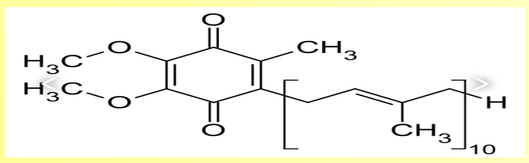
Abstract

- Antioxidants are compounds that combat free radicals and reduce oxidative stress
- Low bioavailability of those anti-oxidant molecules results in suboptimal concentrations at their intended cellular targets
- Low bioavailability diminishes their potential to mitigate oxidative stress
- Conducted solubility studies of a lipid soluble antioxidant using different solvents (DMSO, DMF, acetone, alcohol, ethyl acetate etc.)

Introduction

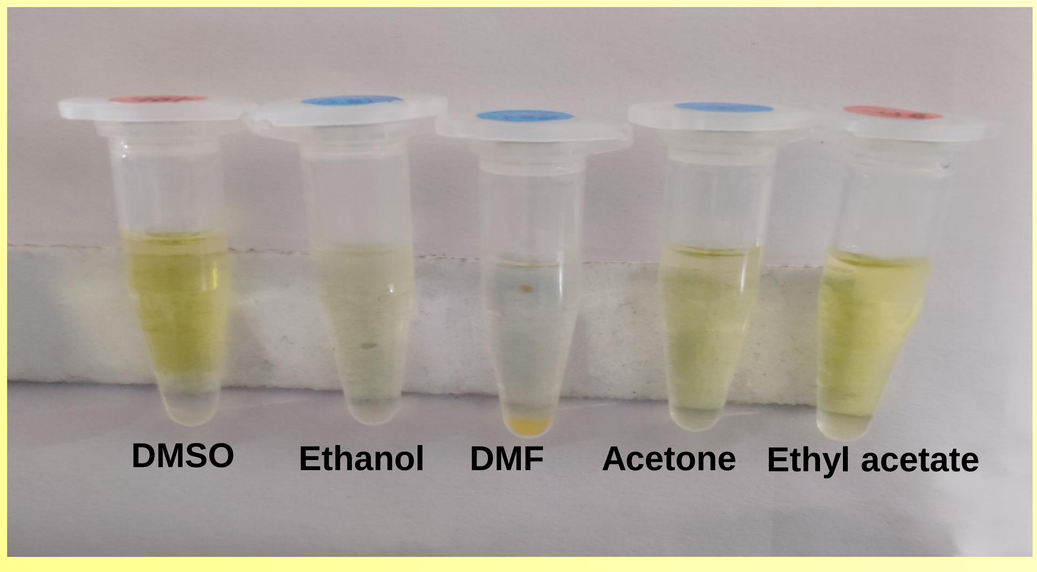
- Coenzyme Q10 (ubiquinone), a highly lipophilic compound found in every cell of human body
- Quinone head is responsible for its antioxidant property while the isoprene side chain contributes to its lipid soluble nature
- Mediates electron transport from Complexes I and II to Complex III
- An antioxidant that protects membrane phospholipids and proteins from lipid peroxidation



Design/Other information

Tested the solubility of CoQ10in different organic solvents:

1) Ethanol
2) DMSO
3) DMF
4) Ethyl acetate
5) Acetone



✓ CoQ10 is soluble in ethanol, DMSO, ethyl acetate and acetone, while it is insoluble in DMF.

Set up

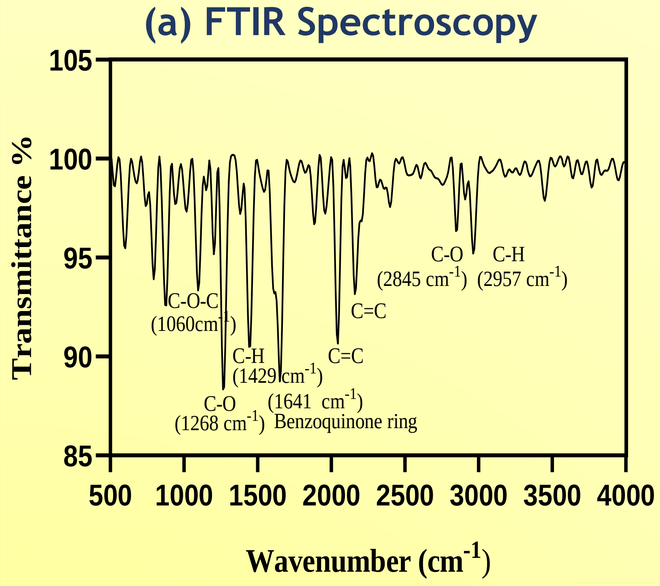
Bioavailability enhancement through Nanoencapsulation:
Loading of CoQ10 into mesoporous silica nanoparticles
By adsorption method:

- Immersing MSNs in a concentrated CoQ10 solution
- Allowing CoQ10 molecules to diffuse into the pores
- Removing excessCoQ10 by washing or centrifugation

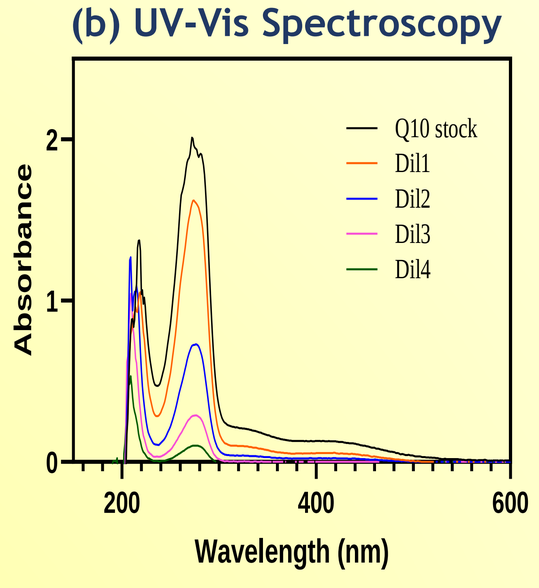
- Bioavailability enhancement mechanisms:
- Increased dissolution rate
- Protection from degradation
- Improved cellular uptake

Results

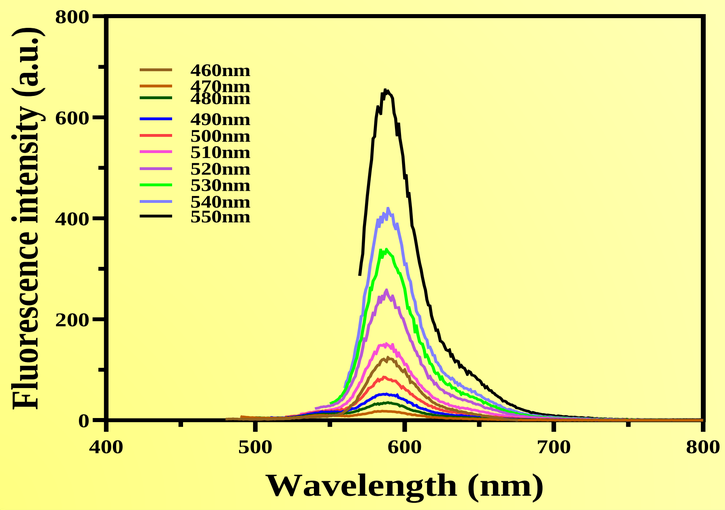
(a) FTIR Spectroscopy



(b) UV-Vis Spectroscopy



(c) Fluorescence Spectroscopy



Spectroscopic analysis of CoQ10:

a) Fourier Transform Infrared Spectroscopy
b) UV-Visible spectroscopy
c) Fluorescence spectroscopy

Conclusions

- CoQ10 is soluble in ethanol, DMSO, ethyl acetate and acetone.
- Maximum fluorescence intensity of CoQ10 at excitation 550nm and emission 584nm
- Absorbance at 284nm

References

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- Bhalani, Dixit V., et al. "Bioavailability enhancement techniques for poorly aqueous soluble drugs and therapeutics." Biomedicines 10.9 (2022): 2055

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