High Power ultrasound Effects on all-β-Carotene

Michel Carail, Anne-Sylvie Fabiano-Tixier, Farid Chemat, Catherine Caris-Veyrat

Influence of ultrasound treatment on the stability of β-carotene

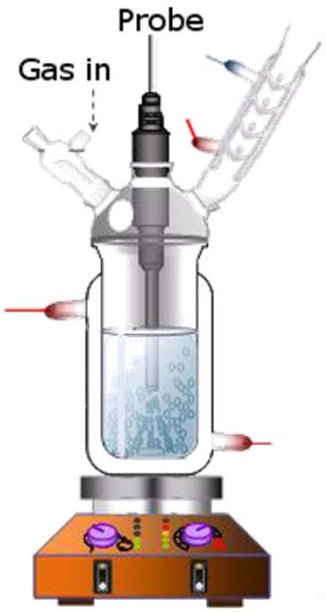
Michel Carail[1], Anne-Sylvie Fabiano-Tixier[2], Farid Chemat[2], Catherine Caris-Veyrat[1]
[1] INRA, UMR408, Sécurité et Qualité des Produits d'Origine Végétale, F-84000 Avignon, France.
[2] Université d'Avignon, UMR408, F-84000 Avignon, France

Introduction:

The aim of this work was to study the influence of ultrasound treatment on the stability of β-carotene.

Material & Methods:

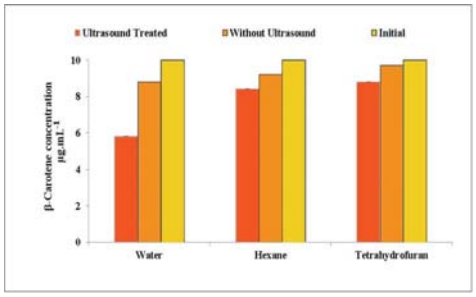
Experiments were performed using a thermostated reactor equipped with a stirrer and an ultrasound probe.

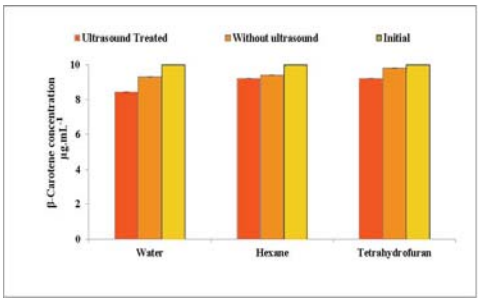


Ultrasonic reactor

Preliminary tests:

β-Carotene concentration decreases significantly in all three solvents under air and argon atmosphere. Highest degradation was found in aqueous medium under air.





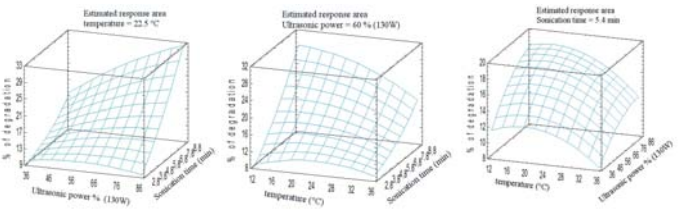
Solvent and gas effects on β-carotene stability. Left: air. Right: Argon.

Experimental design:

Air and water were chosen as experimental conditions to perform a Central Composite Design (CCD) face-centered, in which three parameters were studied : ultrasound power, temperature and sonication time.

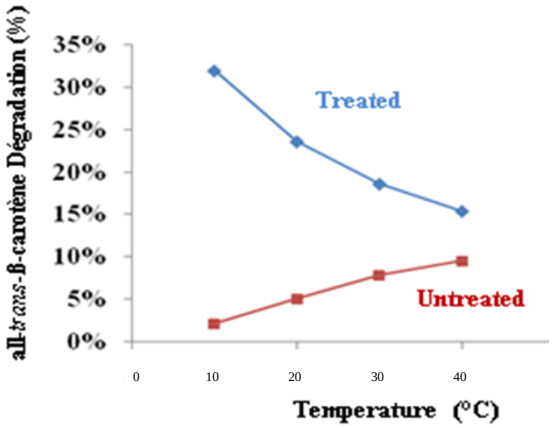
Results:

Most influent variables are ultrasound power and time.



3D response area for degradation of β-carotene

Degradation decreases when temperature increases, due to more effectiveness of ultrasound at low temperature.



Conclusion:

Ultrasound treatment in aqueous medium under air atmosphere induces large degradation of β-carotene. This effect could be due to high energy of ultrasound against water and against β-carotene by cavitation phenomenon. Sonicated water produces Reactive Oxygen Species (ROS) like hydroxyl radical, and pH decreases due to oxygenated nitrogen species like nitric acid.

Ultrasound treatment in food processing must be used carefully, controlling ultrasound power and if possible using neutral atmosphere.

Centre INRA Provence-Alpes-Côte d'Azur
Domaine Saint Paul
Site Agroparc
CS 40509
84914 Avignon Cedex 9
http://www.paca.inra.fr/