



**DSTF**

Dipartimento di Scienza  
e Tecnologia del Farmaco  
UNIVERSITÀ DI TORINO



ATENEIO ITALO-TEDESCO  
DEUTSCH-ITALIENISCHES HOCHSCHULZENTRUM

# GREEN AND SUSTAINABLE APPROACH TO PROCESS INTENSIFICATION

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Faculty of Pharmacy  
Department of Scienza e Tecnologia del Farmaco  
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*Book of Abstracts*



### **P3: Microwaves and Ultrasound for Carbon Nanotubes (CNT) Functionalization**

Emanuela Calcio Gaudino, Silvia Tagliapietra, Davide Garella, Diego Carnaroglio, Giancarlo Cravotto\*

The use of ultrasound (US) and microwaves (MW) in the oxidation and purification of multi-walled carbon nanotubes (MWCNTs) was investigated. These techniques, in particular US at a frequency of 300 kHz, strongly accelerate the process and avoid the heavy structural damage, observed at the 20–35 kHz classic range, even at low power. Due to the residual metal catalyst on the head of MWCNTs, MW heating is strongly absorbed, causing the rupture of the tip and the loss of the metal. All our chemico-physical treatments were performed by suspending the CNTs in a 3:1 H<sub>2</sub>SO<sub>4</sub>/HNO<sub>3</sub> mixture. The resulting samples were investigated by TEM microscopy, TGA analyses and Raman spectroscopy, while the degree of oxidation was estimated by colourimetric analyses. The aim of our project was mainly focused on the development of new synthetic procedures for the functionalization of CNTs bearing imaging reporters and specific drugs to be used as a teragnostic probe. For this scope, the CNTs surface was chemically modified under ultrasound and/or microwave irradiation.

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