



Short Commentary

STEM Education of the Nanotechnology in Chinese Herbal Medicine

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Abstract

“STEM education” is the study of teaching and learning, and “Nanotechnology” is the technology that promises scientific advancement in the Traditional Chinese Medicines. How does STEM education fuse with the nanotechnology of Chinese herbal medicine? This short commentary discusses the modification of a traditional teaching plan, including lectures, laboratory teaching, and activities as well as open-mind discussion. However, it is just the beginning, and much more works need to be done on the nanotechnology and Chinese herbal medicine curriculum in the future for further development.

Keywords: STEM education, Nanotechnology, Chinese herbal medicine

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“STEM education” combines the concepts of science, technology, engineering, and mathematics subjects, which focuses on the study of teaching and learning, while “Nanotechnology” is the technology that promises scientific advancement in many fields such as Western or Chinese medicines, consumer products, energy, materials, and manufacturing^[1]. How does STEM education set up in the nanotechnology of Chinese herbal medicine? It starts with modification of the traditional teaching plan, including

lectures, laboratory teaching, and activities as well as discussion contents.

Nanotechnology lessons for the students consist of the background, principles, and theory which must design more interesting to draw their attention. This ensures that they know the basic concept of nanotechnology before going to individual thinking and group discussion. It is effective for the student to more familiar and with a deep impression of

the learning. Besides lectures, some laboratory teaching and activities are provided after students have the background knowledge, using “Chinese herbal medicine extraction” as an example of the laboratory teaching and activities which divides into two parts:

Part 1: Simple extraction of Chinese herbal medicine, e.g. curcumin, and its applications with nanotechnology.

Describe the usage and biological effect because of curcumin with many pharmacological actions including antibacterial, antiviral, anti-oxidation, and anti-inflammatory properties^[2]. This laboratory section is suitable either for secondary or tertiary students as curcumin is easily extracted by soxhlet extraction, microwave-assisted extraction, and supercritical fluid^[3], but it is preferable to do a soxhlet extraction since the steps are not complicated and use water or ethanol as distillation solvents.

Part 2: Nanotechnology-applied curcumin.

The most common technique is nanoprecipitation with polymerization^[4]. Curcumin mix with the polymer, polyvinylpyrrolidone, to form a stable nanoparticle for the biological application^[5], spread agar plate for the anti-bacterial property^[6].

A discussion section holds when the laboratory teaching and activities are finished. Let students remember and think about what they learned in the laboratory activity. The discussion contents contain but are not limited to:

- (a) What are the pharmacological actions of curcumin?
- (b) How do we extract the curcumin and apply it in nanotechnology?
- (c) Do curcumin has anti-bacterial property? Why?

Student feedback from the discussion contents on the laboratory activities to enhance their critical thinking.

The above teaching plan and flow demonstrate that STEM education fuse with nanotechnology, especially in Chinese herbal medicine. This creates an innovative education field

that combines traditional subjects to become more interesting. However, much more works need to be done including updating and modifying nanotechnology in a Chinese herbal medicine curriculum for further development of STEM education in the future.

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Conflicts of Interest

The authors had no conflict of interest to disclose.

Author Contribution

All authors contributed to the concept, acquisition and analysis of data, drafting of the article, and critical revision for important intellectual content.

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