THESIS SUMMARY

Research title: **Study on the synthesis of silver nanoparticles deposited on porous ceramic materials by gamma cobalt -60 irradiation method to use for *E.coli* treatment in water**

Major: **Chemical technology of inorganic substances**

Major code: **62.52.75.01**

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Abstract

In this doctoral thesis, porous ceramic/silver nanoparticles candle filters were studied and successfully manufactured to treat micro-organism (*E. coli*) in water, especially in drinking water, to improve the quality of water resources and the community health.

In this work, the gamma cobalt-60 radiation was used to synthesize silver nanoparticles (AgNPs) stabilized in polyvinyl pyrrolidone (PVP) solution and AgNPs in zeolite carrier powder. The AgNPs were deposited on porous ceramic candle filter (PCCF) made from rice husk ash by impregnating and sintering method.

Colloidal AgNPs/PVP solution with AgNPs size of 10-15 nm and Ag content of 500 mM was used to impregnate PCCFs that already treated with aminopropyltriethoxysilane (AS). The prepared PCCF/AgNPs/PVP has a silver content of ~200-250 mg/kg, and the bactericidal efficiency against *E.coli* reaching ~99.0%. Water after the treatment meets the standard of bottled drinking water according to TCVN 6096-2004.

AgNPs/zeolite with the size of about 30 nm, and the Ag content of 1.0 - 1.2% was sintered with silica material at the temperature of 1000°C - 1100°C for

preparation of PCCF/AgNPs/Z. The resultant PCCF/AgNPs/Z product has a silver content of ~300-350 mg/kg, and bactericidal efficiency against *E.coli* reaching ~100%. Water after the treatment also meets the standard of bottled drinking water according to TCVN 6096-2004.

The pilot production of 200 PCCF/AgNPs/Z was carried out by sintering method at a porcelain manufacturing company, Hai Duong province, Vietnam. The obtained PCCF/AgNPs/Z products were of the same quality as the test sample and the silver content released in the water was smaller than 100 µg/L. The sintering method to produce PCCF/AgNPs/Z is evaluated favorably for the production of the antibacterial PCCFs. These products have great potential to apply on large scale production to meet the needs of direct drinking water treatment, especially in rural areas and mountain regions.

This thesis has the following main scientific contributions:

- Fabrication of AgNPs/PVP colloidal solution and AgNPs/zeolite powder with production scale by gamma Co-60 irradiation method.
- Setting up two processes to fabricate PCCF/AgNPs products by impregnating and sintering method. Notably, sintering method shows advantages in applying on large scale production. The PCCF/AgNPs/Z products exhibit high efficiency (~100%) of killing bacteria (*E.coli*) in water that meets the standard of bottled drinking water according to TCVN 6096-2004 and the standard of silver content in drinking water (<100 µg/L) of the World Health Organization (WHO).

The sintering method can be carried out conveniently with a reasonable production price and the PCCF/AgNPs/Z would be considered as the promising products for widely practical application in direct drinking water treatment.

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