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Green synthesis of metal nanocatalysts for green catalysisRiny Yolandha Parapat¹, Maya R Musadi¹ and Reinhard Schomäcker²¹ITENAS, Indonesia²TU Berlin, Germany

Designed nanomaterials are still very alluring in various fields including in catalysis for they have outstanding properties. However, along with the concern of global safety and environment, the fabricating of designed nanomaterial is progressing to in a greener way. Among the nanoparticle synthesis strategies, microemulsion technique is one of the most facile yet ingenious methods because of its ability to tune the size and the shape of the nanoparticles by controlling the parameters such as metal concentration, kind of reducing agent and its concentration, composition surfactant and/or co-surfactant, temperature, etc. Previously, we produced well dispersed NPs supported on the different support materials by using our method, namely thermo-destabilization of microemulsion. Here, we improve the synthesis route by using various natural reductants for the preparation of supported Ag, Pt, Pd, Ru nanoparticles. The natural reductants that are used in this work are green tea leaf, coffee beans, grape seed and peppermint leaves. The higher the total phenol content, the stronger the reducing power of the antioxidant will be. It has been reported that strong reducing agent will cause fast nucleation process, thus promoting smaller particle size. Therefore, the finer branches of the Pt dendrites produced by using grape seed are a result of the fast nucleation process. Because all the used natural reductants are classified as the weak reductant, which can control the shape kinetically, therefore all the NPs have anisotropic structures. However, from Fig. 1 we can see that applying the same natural reductant for other kinds of metal will also produce different thickness of the branches. In case of Ru NPs, when using coffee as reductant, there is a kind of shell that covers the particles. Adding Cu precursor to the Ru solution at room temperature creates another NPs structure which looks like nanoflakes. After applying our green nanocatalysts in greener catalysis such as levulinic acid hydrogenation, we found that our nanocatalysts are more active compared to those which were prepared with other methods.

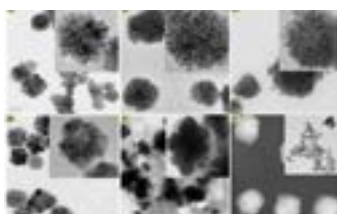


Figure 1: TEM images of different metal NPs produced by natural reductants: Pt with ascorbic acid (A), Pt with green tea (B), Pt with grape seed (C), Pd with ascorbic acid (D), Ag with green tea (E) and Pt with caffeine (F). We put SEM image (F) for the sake of clarity because the real structure of Pt dendrites was destroyed by the electron beams when using TEM (inset).

Biography

Riny Yolandha Parapat has her expertise in synthesis of nanocrystal via microemulsions technique. Her great passion is to create and develop nanomaterials especially in the field of catalysis. Because she is also concerned about the environment, her research is now heading to the field of green synthesis and biofuel production. Her advanced knowledge and experience in microemulsions making her able to synthesize and design the super active nanocatalysts in a greener way. She has discovered a new method to synthesize highly active supported nanocatalysts, so-called thermo-destabilization of microemulsions. Not only is she active in doing research, she is also a Lecturer in the course of kinetic and catalysis, experimental design, process control, and plant design.

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