FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
AND
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(See Section 10; rule 13)

T I T L E

"A METHOD TO PRODUCE SUPPORTED NOBLE METAL NANOPARTICLES IN COMMERCIAL QUANTITITES FOR DRINKING WATER PURIFICATION"

APPLICANT

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The following specification particularly describes
the invention and the manner in which
it is to be performed

This invention relates to a process for producing supported noble metal nano particles. This process is suitable for large scale commercial manufacture of supported noble metal nano particles.

Nano particles that are suitable for adsorption in activated porous materials are gold, silver, copper, cobalt, nickel, platinum and their alloys.

Researchers have established that gold and silver nano particles are capable of removing harmful pesticides and the like contaminants from water. In the purification and decontamination process of water for drinking purposes, nano materials have been found very useful and effective.

An object of this invention is to bring this advantage of science to the masses and to produce nano particles adsorbed in porous support material in a cost effective manner. Production of low cost nano based filters may be made available to the society for various applications such as water purification, including on live filtration, industrial and community based filters.

Activated alumina SiO_2, TiO_2, MgO, Fe_2O_3 activated carbon, bone charcoal calcite, Zeolite, red mud, clay, thermo-plastic resins such as polystyrene and Teflon, thermosetting resins such as phenol formaldehyde either alone or in admixture may be used as porous activated support material for nano particles. These activated materials have large surface area and good porosity and are ideal for making filter devices containing nano particles.

Nano particles adsorbed in these porous materials are easy to fabricate and have good surface exposure of the adsorbed nano particles. This helps increased reactivity of the nano particles due to increased nano particle surface interfaces.

This invention will hereafter be described with reference to gold / silver nano particles and activated neutral Al_2O_3 support though it does not exclude the other noble metals and activated support from its scope.

Nano particles of Ag/Au loaded onto porous activated Al_2O_3 support find application in decontaminating water. The nano supported Al_2O_3 porous material can be obtained and conventional each of the nano particles is not noticed during purification of water. Therefore the supported nano particles of this invention is very cost effective. Conventional methods of nano particle deposition on porous materials involve saturable adsorption / impregnation or co-precipitation. The next steps are solvent evaporation and air drying. Subsequent calcinations is followed to convert surface hydroxides of the support material to corresponding oxides. Another important aspect is the high cost of nano particles. Accordingly careful use of nano particles while processing the porous adsorbent body is a must. Another desired feature is uniformity of coating and effective coating of all the exposed surfaces of the support material. In the conventional methods there exists problems in controlling the size of the nano particles because of the calcination step involved.

The object of this invention is to provide a simple and effective process for synthesizing and adsorbing nano particles on porous adsorbants. Calcination step is avoided and liquid medium in the nano particles are present during adsorption ensures uniform coating and provides optimum effect from the adsorbed nano particles. Yet another object of this invention is to control the nano particle adsorption as desired and only the desired amount of nano particles are adsorbed.

This invention relates to a process for producing noble metal nano particles supported on porous activated support material comprises the steps of preparing nano

particles of a noble metal in liquid phase in a known manner, allowing the solution containing nano particles to pass through a column of activated porous support material till the adsorption of nano particles reaches the desired level and till the support material attains the brilliant colour of the said nano particles and thereafter washing said porous material coated with nano particles with distilled water and subsequently drying the same in air to obtain a fine free flowing product.

This invention will now be described with reference to the following examples.

192 L of 5 X 10^{-4}M stock solution of silver nitrate in water was diluted to 961.5L and heated to boil 38.5L of 1% sodium citrate solution was added and the heating continued till the colour turned golden yellow. Total quantity of nano particles formed is 10.4g.

Activated Al_2O_3 (neutral, white) having a surface are of 150 – 300 m^2/g and bead size of 200 μm–1cm was taken and a glass column of 110cm diameter and 1 m height was tightly fitted with said activated Al_2O_3 . A narrow opening was provided at the bottom with a regulating means to control the flow of liquid through the column. The solution containing nano particles of silver was then poured into this column at a temperature of about 50°C. As the solution flows through the column, the nano particles get adsorbed and the column acquires the colour of the nano particles. Activated Al_2O_3 becomes brilliantly coloured once the adsorption is complete. Nano particles may be prepared from noble metal carbohydrates metal salts and other covalent compounds. After this, the column is washed with distilled water and thereafter removal from the glass column it is air dried to obtain fine particles and may be stored in air tight bags. It is found to be stable for several months. The size range of nano particles may vary from 5 - 200 nm.

Support materials selected from SiO_2, MgO, TiO_2, Fe_2O_2 activated carbon bone charcoal, calcite, red mud, clay thermoplastic and thermosetting resins and Zeolite may also be used instead of Al_2O_3 .

Similarly, other noble metals like gold, Cu, Co Ni and Pt may also be suitably substituted for silver.

This invention will now be described with reference to the single figure in the accompanying drawings. It represents the schematic diagram of commercial scale manufacture of the supported noble metal nano particles.

C_1 and C_2 are chambers in which nano particle formation takes place. Silver nitrate or a suitable noble metal salt solution may be allowed to enter C_1 and then to C_2. S_1 and S_2 are stirrers positioned inside these chambers while AMC is the adsorbent material column, D is the drier and OVD is the oven drier where the adsorbed activated particles are air dried and then sent for packing. WTP is the Water Treatment Plant and P_u is the pump to supply adsorbed nano particles to a water treatment plant.

Vacuum driers, centrifugal driers and oven driers may be used for removal of water from the adsorbed nano particles in the column.

This invention also includes devices for filtration and decontamination of fluids containing adsorbed nano particles prepared by this invention.

Obvious modifications and alterations known to persons skilled in the art are within the scope and ambit of this invention and the appended claims.

WE CLAIM:

1. A process for producing noble metal nano particles supported on porous activated support material comprising the steps of preparing nano particles of a noble metal in liquid phase, allowing the solution containing nano particles to pass through a column of activated porous support material till adsorption of nano particles reaches the desired level and till the support material attains the brilliant colour of said nano particles and thereafter washing said porous material coated with said nano particles with distilled water and subsequently drying the same in air to obtain a fine free flowing product, wherein noble metal nano particles are formed by the addition of the sodium citrate solution under stirring and the produced nano particles are capped with citrate ligands.

2. The process as claimed in claim 1, wherein said noble metal is selected from gold, silver, copper, cobalt, nickel, platinum and their alloys and the activated porous material is selected from neutral Al_2O_3, SiO_2, MgO, activated and bone charcoal zeolite, thermo plastic and thermosetting resins.

3. The process as claimed in claims 1 and 2, wherein the size of nano particles is in the range of 5 to 200 nm.

4. The process as claimed in claims 1 to 3, wherein drying is carried out at a temperature of about 50°C.

5. The process as claimed in claims 1 to 4, wherein the nano particles adsorbed support material is formed into pellets, granules and fibres.

6. Noble metal nano particles supported on porous activated support materials when produced by a process as claimed in claims 1 to 5.

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-Digitally Signed-

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ABSTRACT

Patent Application No. 1879/CHE/2007

A METHOD TO PRODUCE SUPPORTED NOBLE METAL NANOPARTICLES IN COMMERCIAL QUANTITITES FOR DRINKING WATER PURIFICATION

This invention relates to porous neutral support material having nano particles of noble metals adsorbed therein prepared by first preparing a liquid containing nano particles and allowing this to be adsorbed by the porous material till the desired amount of nano particles are adsorbed. This is then washed with distilled water air dried and packed. This material is useful in decontaminating water for drinking purposes.

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ORIGINAL

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AQUAMALL WATER SOLUTIONS LTD.
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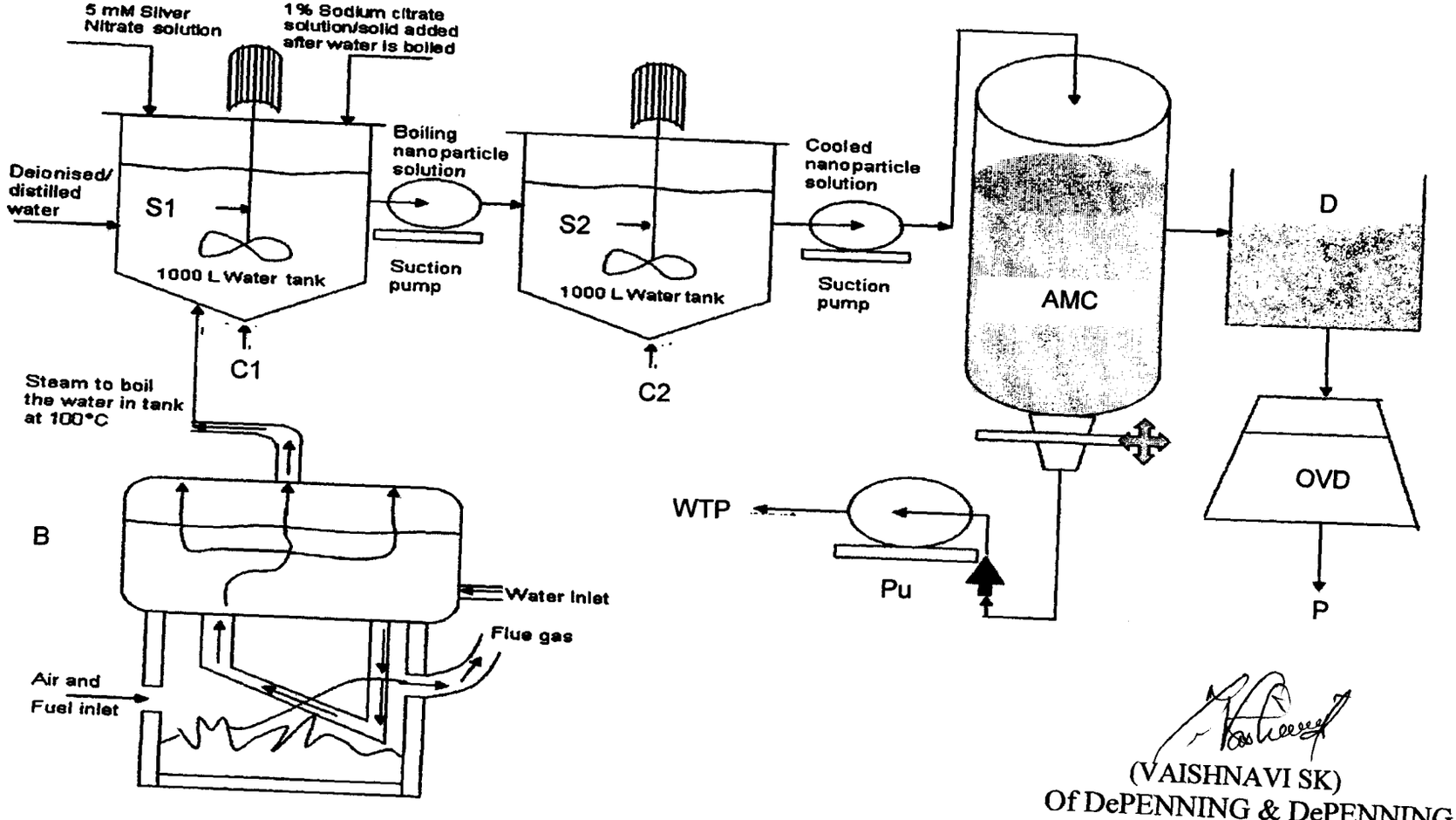

Figure 1

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