EXTENDED ABSTRACT
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Electrophoretic Devices and Metal organic Protein molecules for Nano-technology"# 138195

Nitosh Kumar Prof. Brahma,
Chemical Engineering, Indian Institute of technology,
Kharagpur-721302, India., Kharagpur, 721302, India

Electrochemistry and electrophoretic separations are recently being used for various protein and DNA separations and electrofucusing, to determine the nature of protein and DNA molecules. Organo metallic (Ga, In Th, Cd, Pb and Cu) complexes are also being used for various thin film development and for the use of bio-medical uses. In this paper the author will discuss several development of metal organic complexes via bacterial propagations, specially Escherichia coli and Thiobacillus ferrooxidans. They were adapted to grow on heavy metallic sulfide complex at the concentration levels of 0.02mg/ml -20 mg/ml. The surface antigenic protein properties of these grown bacterial strains were isolated and were measured for conductivity at various pH and temperatures. The data revealed, that depending upon the electro potential values of metals and elemental groups, that surface antigenic properties of T.ferrooxidans and Escherichia coli K-12 surface cell wall isolates were changed. That prevailed that the isolates carried various organo-metallic components, which could be useful in future for the development of low energy intensive microchips and transmitting microampere thin film products.

Development of benign Organo-Metallic Nano-particles [1].

Isolate metal leaching bacteria from Coal, Copper, Zink and Gold mines.

→ Separate and isolate them for various acid leaching mediums

→ Study the genetic and surface antigenic properties of these strains, potentiality adapting the environment of Cu, Zn, Au, Ga, In or Th elements, and their sulfide ores.

→ Study their plasmid genetic and surface antigenic protein properties. An E.coli K-12 would be used to generate a hybrid transgenic strain, which will possess the information of metal acidic growth and leaching. To compare the protein natures in wild types and in hybrid progenies, to study the change of surface proteins with or without metal nano-particles bindings, following methods were followed

→ Isolate their surface protein and measure their conductance while they were grown in any of the following or combined elemental inorganic solution.

→Use them to study their change of protein conductivity in milli volt and ampere activities on glass plate by preparing a thin film. The process for drying the organo-metallic thin film is to discussed somewhere. The antimicrobial properties of silver are well known since ancient Greece. Silver nano-particle is used as disinfectant in children's eye drop and for lining of water and drinking glasses in boats, ships and aero plans to ensure safe for drinking of water for several months. The dramatic increase of surface area by the fall of particle sizes below 100 nm has been performed graphically and by experimental results derived in this process, Fig.1. It has been proved, that in the functionality of Nano-technology, the electron configuration both biological nano-tubes as well as in organo-metallic complexes or in complexes of purely inorganic components are basically based on the change of electron configuration that are being dominated by the natural elements and heavy metals, namely copper (Cu), Gold (Au) Silver (Ag) and several others. It would be realistic to think, that in the same manner the most challenging research to prevent arsenic poisoning can be prevented, if As^{3+} or As^{5+} are being permanently stabilized by the use of membrane where nano-particles of Silver (Ag) or other rare earths metals are involved. However it would be true, that the electron configuration of Arsenic metal, both in As^{3+} and As^{5+} oxidation stages can be modified if Ag (Silver) nano-particles is permanently binds as not dissociable element and as nano-As-Ag complex. This would be environmentally benign and would not be harmful to the body. As- bound surface S-protein which could be useful as vaccine to prevent body against arsenic contaminations and poisoning, [1-6] So the change of electron configurations on metallic complex and with increasing surface area show the basic paradigm of elemental behaviors at particle size of 10^{-9} meter (m). Fig.1 shows how this paradigm of surface area could be changed by decreasing size of particles. In MBST (Membrane Based Separation Technology), the membrane can be prepared in a hybrid metallic complex of silver ions in polymers, which could be effective for killing bacteria during water purification and separations of ingredient. In this process the fouling of microbes can also be reduced, since Silver (Ag) is bactericide (killing bacteria) it will kill bacteria. Bacteria on the other hand cause not only the diseases of human and domestic animal but also the fouling of membrane, when the membranes are remained yeas long in use. In the separation technology, during membrane separation additional UV- intensive rays are used to kill bacteria. However in some cases the mutated bacteria, that are being caused by UV-radiations may transmit though membrane and could survive as mutant to human system. So there are some hazards in the technological developments existing, which could be managed with the help of nano—hybrid technology.

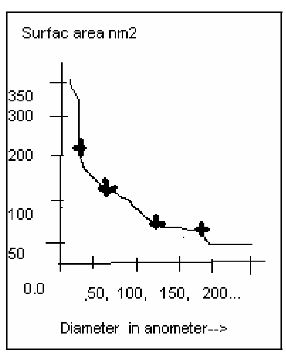

Fig.1.The change of increasing surface area in m^2 by decreasing the diameter of particle

The growth propagations of ***T.ferrooxidans***, the changing of biochemical properties in presence of Fe^{2+}/ Fe^{3+} and the kinetics of the reduction of sulfide mineral particles, as simple "Particle Core Model" , for reasonable reactor model and for industrial applications are correlated. The ***Thiobacillus ferrooxidans*** were isolated from copper leaching solution and were used for preparing organo-metallic thin film to measure conductivity both in normal and at cryotemperatures. It was realized and found through conductivity measurements, that the change of conductance were varied according to the change of metallic solutions involved in aciophilic bacterial growth at pH 1-

2. In various concentrations of Copper (Cu), Silver (Ag) and Nickel (Ni), the isolated metal organic properties of ***T.ferrooxidans*** were varied. The development of biochips or other thin film variable conducting organo-metallic components with help of acidophilic microbes can be initiated to perform and to design metal and protein complexes. By change of surface of the cell wall s-proteins [1,2], which is unique as biocompatible elements. The research activities on microchips and large-scale production of composite nano-materials are under investigations. Further to nano-technology and the application of inorganic particles, it is mentioned that the slow developments of organo-metallic nano-particles have been studied few years ago by the author. It was observed, that bacteria (specially) acidophilic microorganism are potential to manipulate sulfide minerals for their own metabolic activities in a complete inorganic environment at pH 1-2, and in absence of carbohydrate. In case of adaptive bacterial growth Escherichia.coli or other acidophilic microbes, bacillus (***Thiobacillus ferrooxidans***) can be gown in silver ion to generate silver binding protein for targeting specific drug applications.

Baterial propagations and metabolic activities of T.ferrooxidans.

Acidophilic, chemolithotrophic, sulfide and Fe^{2+} oxidizing ***Thiobacillus ferrooxidans, Ferro bacillus ferrooxidans, Thiobacillus thiooxidans and Ferro bacillus thiooxidans*** are found suitable in solubilisation of sulfide containing low grade metallic ores, like Cu, Au, Ag and Zn and U. ***T.ferrooxidans, T.Thiooxidans, F.ferrooxidans and T.thiooxidans*** are belonging to the family of chemolithotrophic, auxototrophic bacteria, and are efficient to generate organo-metallic, nano-particles from sulfide ores, (a) It allows for the economic extraction of valuable metals from low grade ores. (b) Involves low capital costs.(c) Involve low energy inputs.(d) Utilizes simple methods. (e) Recovers the pollution of environments and finally it can design various nano-particle based thin film and composite materials, which are benign to the environment. For recoveries copper form $CuFeS_2$ and at the same time to recover copper and other nano-particles slow agitated CSTR (continuous stirred tank reactors) in series would be required to increase the residence time($\tau = V_R$ (Volume of the reactor in lit or m^3 / V^o (flow lit/ h). The understanding of bioenergetics properties of chemolithotropic oxidoreductase microbes essential support electron transports of bacterial cell walls was required. The increasing residence time the slow growths of bacterial populations, facilitated electron transport through cell wall of ***T.ferrooxidans***, and the metabolic, bioenergetics activities in presence of CO_2 and at pH 1- 2 are fully characterized by their extra cellular metabolites (cytochrome similar enzymes) oxidoreductase activities of ***T.ferrooxidans*** in sulfide leaching and bioremediations.

$S^{2-} + 2O_2$ T.ferrooxidans→ SO_4^{2-} + 8 e-……………………..(1)

Similarly the reduction of ferric to ferrous is occurred with the help of these liberated electrons and the conversion of H + + e- -→ H_20 is reproduced by the following biochemical reactions;

Fe^{2+} --T.ferrooxidans→ Fe^{3+} + 8 e --→ Fe 2+………………… (2)

$S^{2-} + 8 Fe^{3+} \rightarrow S^{6+} + 8 Fe^{2+}$……………………………..(3)

$S^{2-} + 2 Fe^{3+} \rightarrow So + 2 Fe^{2+}$…………………………….(4)

and the elemental sulfur to sulfuric acid according to the following equation.

So + H_2 O +3/2 O_2→T.ferrooxidans-→ H_2SO_4………….. (5)

$H_2O \rightarrow 2 H^+ + O_2 + 2$ e -………………………………...(6)

H+ -→ Membrane of T.ferrooxidans→ NADP+ H+ -→ NADPH……... (7)
ADP → ATP→ DNA→ RNA-> Polypeptides and bacterial population... .(8)

In general ferrous ion is oxidized to ferric in presence of T.ferrooxidans. ***T.ferrooxidans*** uses Cytochrome similar "Coenzymes Q" as an intermediary electron carrier to liberation electrons from sulfide to sulfate and ferrous to ferric in a reversible recycle in supports of hydrogen ion concentration to form linear polymeric chain of sulfur atom bound lipoprotein for the fractions of outer membrane ATP.

Materials and method:

The mutant strains were isolated from concentrated (35-200 mg/ml) $CuSO_4$ solution dissolved in 9K Lundgren medium [1] activated by 120 mM $FeS0_4$ at pH 3.0. Oxidoreductage activity of CSP was characterized in presence of trace amount enzyme cofactors, like urea, ATP (Adenosine tri-phosphate), NAD (β-Nicotinamide adenine dinucletides) and G-6p-DH (Glucose 6-phosphate dehydrogenate) were used to follow the change of ferrous ion (green) color to ferric (yellow) color, during reaction [Brahma,(1992)]. Cell free CSP enzyme activities in Fe2+ / Fe3+ oxidation & reduction were estimated spectrophotometrically at UV.Vis range of 340, 420 and 570 nm.

Physical and biochemical properties in formation of organo-metallic protein molecules by acidophilic microbes.

Physical parameters: 1.Temperature [35oC], 2. pH.[2-3] EMK (elecro motor Kraft)[500 mV], 4. CFe2+ [10 g.lit-1], 5.CS2- [10 - 25%]. 6.Bacterial inoculums [5 to 7%], 7. Nutrients, [$(NH_4)_2SO_4$ (3.0 g.lit-1), K2HPO4 (0.5 g.lit-1)], FeSO4 [10-14%], CCO2 [0.2%v.v-1], CO2 [maximum 8 v. v -1 %]. Particle size of the ores [< 32 mu].

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