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New Materials for Biosensor Construction

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1. Introduction

Currently materiel development and characterization have attained a central position in science and technology to meet out conventional and unconventional challenges in exponentially growing demands of civil society. Science, technology and society now are closely correlated to serve mutually where materials sever as most fundamental interface and initiator for dedicated and non-dedicated applications.

Materials are most significant entities which constitute body of all objective things may be living or non-living being on the basis of structural stability. The structural components which develop binding forces are critical components of the materials. The materials are of two basic categories such as non-molecular and materials molecular. Of course, under non-molecular materials (NMM), the composites, blends, alloys, eutectic mixtures, acoustic materials constitute most industrially useful sensors mainly for non-biocompatible applications. However, some of them serve as a most biocompatible material such as polymer blends as contact less, stainless steel as bone substitute to normalize a function of bone when it fractures. The NMM serve as basic materials for communication, building materials, machine materials, computer ware materials and many others.

2. Constitutional biosensing property genesis

The molecular materials due to structural identity do sever as most excellent biosensors because of certain structural changes which are trapped in form of certain impulse in electronegativity, chemical potential, electrical signal, change in shared electron pair, free energy, entropy, internal energy change, enthalpy change, friccohesity change. In general, such changes are referred to as physicochemical properties (PCP). When the PCP predicts or conveys certain signal or senses as an outcome of biological, biochemical, biophysical, biotechnological, bioengineering phenomenon and similar others then the PCP act as physicochemical indicators (PCI). The PCI also encompasses certain signals created due to oxidation and reduction process and hydrophilic and hydrophobic interactions along with ionic responses.

In this context a new materials to be prepared and act as biosensor must have definite sites in molecules which can either undergo change or indicate some shear stress and shear strain to be detected as a signal to analyze a nature and type of phenomenon being executed at the operational site. Several molecules such as DNA, RNA, proteins, enzymes, hormone etc. do have giant size with manifolds responding sites which are covered under a new concept

IMMFT (intramolecular multiple force theory) reported elsewhere [1]. For example, egg phosphatidylcholine (EPC) with multiple force points behaves as an emulsifier type sensor to detect hydrophilic interactions while the cetylpyrridiunium bromide (CPB) with cetyl carbon chain with uniform covalent bonding force (UCBF) due to sp^3 orbital hybridization behaves as surfactant type sensor to depict hydrophobic interactions. Thus the EPC is a biosensor for scaling viscous property through intermolecular forces whiles the CPB as a cohesive forces scaling through hydrophobic mode [1, 2].

2.1 Fundamental energetics

Fundamentally a molecular mechanism of biosensor is thermodynamic in nature as each and every structural change is accompanied with free energy and entropic change. According to first law of thermodynamic the energy neither destroyed nor created but transformed from one form to another. It is depicted as q = ΔE +PdV, q is enthalpy change, ΔE is internal molecular change and PdV is physical work done in energy change process as the P is pressure and dV, a volume change. Also the structural changes are depicted with simple thermodynamic change for energy transformation equation 1.

$$dG_{mix} = \left(\frac{\partial G}{\partial p}\right)_{T,n1,n2} dP + \left(\frac{\partial G}{\partial T}\right)_{p,n1,n2} dT + \left(\frac{\partial G}{\partial n_1}\right)_{T,P,n2} dn_1 + \left(\frac{\partial G}{\partial n_2}\right)_{T,P,n1} dn_2 \quad (1)$$

It analyzes a change on mixing n1 and n2 moles at dP = 0, dT = 0 and depicted as equation 2.

$$dG_{mix} = \left(\frac{\partial G}{\partial n_1}\right)_{T,P,n2} dn_1 + \left(\frac{\partial G}{\partial n_2}\right)_{T,P,n1} dn_2 \quad (2)$$

Equations 1 and 2 define chemical potential response as base for biosensor with no physical changes. The internal energy also matters a lot in biosensor q = ΔE + PdV. Thus the molecular constitutions fundamentally illustrate a fundamental science and mechanism of biosensors without which it is impossible to develop any molecular device for biosensing to be used efficiently. Thus for understanding a theme, theory and mechanism of sensor, a broad view is an essential step and knowledge before initiating and designing application of biosensors. The molecular identity is must during biosensing action mechanism. Of course, the biosensors do have potential and befitted in current trends of nanotechnology and green sciences in analytical and materials sciences. Technically, there is a lot more hidden potential within molecular world if it is unearthed and proliferated in right direction and suitable applications. The biosensor could not only open new gateways of ample new opportunities but could also constitute exponential synergies to synchronize molecular potential to a level of nuclear sciences for positive works. Currently, molecular sciences have gathered enough momentum for wider applications in chemicals, medical, biochemical, biotechnological, biophysical, biotransformational, bioelectronics biomembrane, osmolarities, electrical conducting charges along interesting and powerful potential of bioconductance in field of fluid sciences (1, 2). Quarts materials with pi-mesons and similar other subatomic particles could also simulate biosensor sciences. In layman language, the sensor word reveal or do indicate some dynamic activities associated with molecular materials. Of course, the non-molecular world could equally be benefitted in applied sciences in space research, telecommunications, electronics etc. Here, the focus is on biosensor which could generate some formative signal of particular activities which is readable or measurable with accurate and reproducible analytical equipment. The biosensors are molecular materials with definite

molecular constituents organized in a specific electronic configuration and geometries to have integrated impact like benzene when dissolved in water no thermodynamic properties water are changed. In contrary to this, when ethanol is dissolved in water the thermodynamics is changed and a resultant aqueous ethanol mixture exists with totally new sensing properties. The benzene sp^2 hybridization is intact when is brought in contact of water but the sp^3 hybridization of the ethanol quickly senses and responds a presence of the water environment. It is very true in case of alcohol intake where the later quickly bind with body water and tightens the muscle and body becomes stiff on alcohol intake.

2.2 Biothermidynamics support

This is a real mechanism of biosensor. For example, DNA, RNA, proteins etc. with definite biocompatible molecular constituents do perform critical role in body, and also DNA finger printing is a great biosensor. Thus there are certain molecular accessories which initiate energy ridges and anchor interacting tools to be nourished as a phenomenon for furtherance or amplification of specific signal. Thus the highly biocompatible molecules like proteins, drugs, biopolymers etc. act as biosensors where such molecules undergo several mechanism like oxidation and reduction; hydrophilic and hydrophobic; interstitial placements, shifting shared electron pair to more electronegative atom within molecules. The abovementioned interacting molecular accessories (IMA) as critically potential molecular nut bolt (MNB) do induce and exert molecular interacting engineering (MIE) which are responsible for molecules to behave as biosensor.

The IMA and MNB together create paces and phases with different electric or chemical potentials to develop working and biosensing thermodynamic spontaneity (BTS) (2) to develop interacting vacancy in search of equilibrium due to $\Delta G \neq 0$. The BTS is tool to equilibrate $\Delta G \neq 0$ into $\Delta G = 0$ with a thrust to homogenize liquid mixture, may be in context of chemical potential $\mu = (dG/dn)_{P,T}$. The fundamental function μ generates IMA followed by MIE under constant P (pressure) and T (temperature). Thus for biosensor efficiency and mechanism the MIE and BTS are unavoidable tools, in fact, these are the fundamental molecular accessories to generate required properties of any individual molecule to act as biosensor. Therefore, the materials which are to be constructed to work as biosensor must have capability and capacity to initiate and cause the BTS. Incorporating abovementioned factors specifically the IMA and MNB to have effective MIE with excellent BTS, lead to simulate changes and integrate certain signal to visualize measurable or sensible indicators. Such generation, construction and formulation of MIE lead to certain sciences like surface and bulk reorientation in molecular energies (3).

For broad elaboration of developing effective biosensors few molecular activities or initiative dents could be noted as essential accessories for successful biosensing mechanism. These are as collision and kinetic activities, electrostatic, solvent activation, pH change, photosensitization, temperature induction, activity coefficient, solubility product, complex product, ionic exchange, solvent saturation point, colloidal formation, critical micelle concentration. Any of the above mentioned activities either independently or in combination of others could integrate in terms of structural potential which could complete a biosensing processes and products then the foundation of biosensor is excelled in practical uses for their effective and reliable validity industrial as well academic applications. Also the reproducibility of any individual molecules to act as biosensor is based on the molecular reorientation, optimization, energetics, friccohesity, interaction engineering, localized molecular potential, molecular potential distribution for efficient working and reducing energy barriers of individual processes with advanced binding or lock and key model based kinetics.

3. Electrostatic science of biosensor

Broadly speaking, the biosensor, in general, specifies a change in chemical systems as environmental systems where if temperature goes up then surrounding too respond accordingly. For example, global warming is due to solar radiation absorption which raises temperature of the globe due to solar radiation absorptions which are electromagnetic radiation (EMR). The EMR interacts with polar gases HCl, N_2O, SO_X, CO_X (x=1, 2, 3) and water vapor (H_2O) which are noted green house gases and sensor for global warming where whole ecosystems influenced. Thus environmental biosensor too play critical role for sustainment of ecosystem. For example, during weather change, the people get cold or some other disease that is due to temperature variation as the human body responds temperature changes and dissipate and dimensionalized the energy level enhanced due to rise in temperature. This theory is based on $\Delta G \neq 0$ where the BTS theory equilibrates $\Delta G \neq 0$ into $\Delta G = 0$ to homogenize body equilibrium.

Fundamentally, the biosensor is not an industrial phenomenon but a way out of chemical thermodynamics where an additional energy of molecules accumulated on specific molecular constituents is utilized in reorientation to get optimization in prevailing environment in the body or other living beings. For example, when Hg (mercury) thermometer is kept in 10°C water bath, the Hg column remains near bottom but when the temperature goes to 50°C, the temperature goes to high level. In this process, a well defined thermodynamics work is done explained with $q = \Delta E + P\Delta V$ equation. The physical work w done in Hg process is $w = P\Delta V$ where the p is pressure and v is change volume. The $v = \pi r^2 h$, r column radii and h is its height, hence work done $w = p\, \pi r^2 h$. Notably, the h is either higher or lower not because of a pressure change but due nature of Hg which on heating expands and runs up which is an excellent sensor of temperature control, and could be extended to similar other systems.

Previously so many direct physical devices were used to make change and to check the temperature points. Similarly, the low pressure in specific area of globe cause storm to come which is very much fitted in $\Delta G \neq 0$ as a strong BTS is developed to equilibrate $\Delta G \neq 0$ into $\Delta G = 0$ with no pressure change. So biosensor is basically used for different uses. The bioscience human body is associated with specific molecules to perform several functions to do the work or dock specific molecule or ions or cells to normalize the body functioning. For example, certain medium when given do reduce body temperature which is an indication of their effect on the body. So biosensors are basically used for different used. Soap or detergent is another biosensor to remove dirt particle from textile fiber similar in $\Delta G \neq 0$ to $\Delta G = 0$ manner. So several highly useful products are in use in society where biosensor do play constructive role. For example nutrients, essential oils, salts macronutrients which automatically indicate either surplus or deficiency in body. The biosensor only predict and hint about so many products and properties of molecular like conductance, viscosity, surface tension, chemical potential, Gibbs free energy and devised according as optical sensors, electrical sensors, temperature sensor, electronic, volume or pressure of gases in blood, sound sensor based on acoustic biomolecules, DNA sensor, protein sensor and others.

4. Conformations backup to biosensor

Current thrust is to construct or synthesize materials which could be used as safer and sure efficient biomolecular sensors (EBS). The EBS mechanism is conceptually works on

structural reorientations and conformations (SRC) of molecular constituents which are highly compatible to human activities in body. Sure and pure study of all possible SRC are studied in detail and ensured that no unwanted structural conformation is developed in newly developed biosensor. As the structural configurations do develop binding and interacting capacities with different molecules in body, for example, the phytic acid (Fig.1) intake binds with calcium ions and cause deficiency of calcium. The phytic acid is in hulls of nuts, seeds, grains but cooking food slightly reduces it so a sprouted food with skin is good behave as excellent materials. The phytic acid is a chelator of minerals Ca^{2+}, Mg^{2+}, Fe^{3+}, Zn^{2+} and causes mineral deficiencies in people that result into osteoporosis. The osteoporosis is a bone disease accessible to increased risk of fracture due to lower bone mineral density (BMD). It aqueous mixtures cause unique IMF with drastic change due to much structural interactions depicted with Friccohesity data.

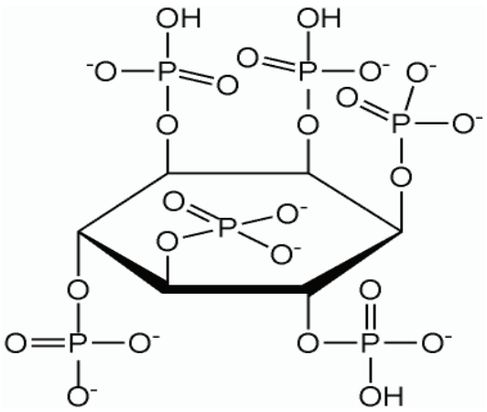


Fig. 1. Phytic acid

Thus the few new molecules are being developed in reference as construction of new materials. Hunger is another sensor to take food, a thirsty another sensor to maintain the water intake in body. Ambition is another sensor to work hard and curiosity too to know more and more, sleeping is another sensor to provide rest to muscles.

5. Novel science of biosensor materials

Biosensor science is a pure thermodynamics process because when plastic touched with electric connection and the electronic wire does and allow bulb to light. The metallic wires coated with plastic due to electronic and non-electric release respectively. Hence ideal materials can't work as biosensors in body but get deposited like cholesterols. There are ample opportunities in body as several biomolecules are gigantic heteromolceucles with several functional groups which could act as ideal biosensor if studies are devised and conducted accordingly. Each molecule does develop specific Friccohenics to diversify the forces to operate molecular forces of biosensor. A hidden potential of biosensor and operational biophysics must be fabricated in scientific manner with befitting biophysical MIE with BTS for biosensor molecular models (BMM) to integrate and exploit or harness the friccohesity model from fundamental molecular unrest and optimization to strengthen potential structural reorientation. In this context few newly developed biosensors (NDB) like poly-N-vinylpyrrolidone oximo-L-valyl-siliconate (POVS) [4], melamine-formaldehyde-polyvinylpyrrolidone (MFP) supramolecules [5] and 2, 4, 6 Tridiethymalonate-Triazine

(TDEMTA) and 2, 4, 6 Hexadiethylmalonate-Triazine (HDEMTA) dendrimers [6] could be of great significance in field of biosensors. Especially, the dendrimers are with unique architectural structures and widely suitable to be as biosensor due to functional end groups in forms of hyper-branched tree like macromolecules.

6. Fundamental molecular engineering

Modern research trends are of innovative supramolecular and nanoparticle-based systems for novel phenomena and applications in different fields. The NDB integrates grey areas of molecular research approaches in the fields of supramolecular, dendrimer, biosensor and smart biomolecular chemistry of hydrophilic and hydrophobic quanta dots within a molecule (7). The NDB could also enhance understanding a technology of liquid crystal devices (LCD), liquid electronic devices (LED) insulators etc. The NDB are most efficient and work based on v = 0, 1, 2, n. are vibrational quantum numbers and total molecular energy (E_{mol}) which is constituted of electronic, vibrational, rotational, nuclear and translational components with many degree of freedoms that lead to either $\Delta G \neq 0$ or $\Delta G = 0$ as $E_{mol} = E_{electronic} + E_{vibrational} + E_{rotational} + E_{nuclear} + E_{translational}$

The $E_{electronic}$ is electronic or a potential energy surface at equilibrium geometry and energies of these components vary with the oscillations. The rheological and IMA, MNB, MIE with TBS could be structurally and quantitatively analyzed with Survismeter [8] which works on $E_{electronic}$, $E_{vibrational}$, $E_{rotational}$, $E_{nuclear}$ and $E_{translational}$ conceptual framework. Such systems have been widely studied (4-6). Intramolecular multiple force theory [IMMFT] is proposed to explain molecular interactions of olive oil-water- egg-phosphatidylcholine (EPC) mixtures with a possible correlation of surface and bulk reorientations with microstructures depicted with SEM. Frictional and cohesive forces as Friccohesity have been noted as driving forces to assert for validity of the IMMFT model and its link with SEM [2].

7. Detailed view of biosensor mechanism

Molecular activities of biosensors are initials and signatures for origin of scientific simulations and frameworks for academic as well as new industrial upcoming. How do the molecules maintain identity under different polarity and electrostatics for sequential structural reorientations? It becomes more important in case of biomolecules such as EPC which being weakly polar involved in biosensor signal as emulsifying agent (9-11). For example, a detection of bound water at moon is an input and incentive to intensify search and research of undiscovered molecular world (12). In year 1953, Stanley and Miller experiment was a pioneer model to signify molecular signatures and several experiments and functions have strengthened a concept of molecular science (13) in search of newer mixtures and properties (14). The biomolecular sciences were studied by many scientists (15) for peculiar structural reorientation optimized to facilitate interactions (16). Since 17th to 19th centuries, several workers intensified efforts to elucidate hidden biomolecular combinations in different polarity (17). The friccohesity of such molecular materials do have excellent control due to their fluid dynamic and collision pattern in medium based on the Brownian motions. The friccohesity incorporated cohesive and frictional forces together with mansingh equation depicted below in equation 3.

$$\sigma = \sigma_0 \left[\left(\frac{t}{t_0} \pm \frac{B}{t} \right) \left(\frac{n}{n_0} \pm 0.0012(1-\rho) \right) \right] \tag{3}$$

For example, Van der Waals emphasizes on conducting and transporting properties along binding forces (18). Debye Huckle theory and Lennard Jones potential distinguished a basic difference in potential and kinetics of biosensor dispersion and motions (19). Theoretically Schrödinger and Born Oppenheimer Approximation (BOA) focused nuclear charge contribution based on quantum chemistry support. A molecular potential before mixing is zero but on mixing is not zero due to interactions (20). For example, oil and water (21) are not much soluble due to weaker interactions (22) but the BOA conceptually explains interactions extended to simple organic or inorganic complexes (23). In such situations the forces inside within a molecule are confined to a centre of control. Onsager and Debye-Huckle, explained a contribution of electrostatics poles of either single ions Na^+, Ca^+, NH_4^+ or Zwitterions like amino acids as alignments of solvents were fitted with biosensor electrostatics (24). For biomolecule such as olive oil does not hold any charge so theories like Debye Huckle could not be fitted for its biosensor activities. Debye could not offer adequate solutions for macromolecules such as proteins where partially ionic peptide bonds were embedded in folding and electrostatic poles were not clearly exposed to solvents (25).

8. Interdisciplinary alignments of biosensor concept and applications

Thus the medium reorientation is effective for embedded electrostatics poles to unfolds the proteins and similar others. Tanford conducted substantial studies on interactions useful for biochemists and biothermodynamists (26). Ludvig Lorenz refined such interactions and approaches of molecular forces, especially of weaker electrolytes as surfactants and mildly partial such as olive oil where forces are confined, redistributed in a local arrangements. This made a better understanding of organic mixtures in a wider way to study oil-water muslins for industrial purposes. For centuries, the molecular framework has been a fascination to scientists for molecular design, polarity, electronic configurations and others. Since origin of life, it has been a never ending process and the scientists, chemists, biochemists, biotechnologists continued their pursuit for further search of either developing new mixtures in laboratories or extracting out of natural sources animal or plants (27). Further, Vander Waals, Lennard and others worked on primitive part of molecular sciences and realized a lot more potential and science hidden which has been furthered various new scientific theories, options, surfaces, intra-surfaces like nanotechnology. Thermodynamics was tried to retrieve hidden molecular energetics such as entropic and free energy changes (28). The studies of biosensor are continued and scientists remarkably contributed to further elaborate and signify their medical potential for industrial uses. From 18^{th} to 19^{th} centuries, a shift from bioionic to biomolecular approaches was noted on a pattern of big debate on existence of atomic theory put forward by Nellie Bohr with evidence and an existence of atomic theory was accepted. Thermodynamic mixtures are easy to explain but the oil and water mixtures with zwitterions as additives need classical support in favor of molecular origin of forces responsible for biosensor sciences. Though several intensely diversified conflicts of biosensor sciences were noted but a molecular force theory (MFT) was unanimously accepted which is still continued.

9. Intramolecular multiple force theory (IMMFT)

Since late 20^{th} to 21^{th} century, trends to develop supra or giant molecules in laboratories either based on metallic ions such as transitional and lanthanides metals (29) or certain molecular rings as core or centermost part or then after branching as an extension for

molecular shape and sizes developed for industrial uses and relevance (30). These sciences revolved around MFT, and originated several diversified molecular forces theories (DMFT) to understand vivid molecular fascinations using biothermodynamics, chemical kinetics, electrochemistry which thinly peeped into inner sides of molecular interactions. The DMFT was put forward and new phenomenon such as friccohesity was emerged to find out a relevance of materials to biosensor such as polymers, drugs, cosmetics, sol gel, electrolytes, solvents, pesticides, disinfectants and others.

It is aimed for opening new gates of knowledge about for industrialization of molecular concept in interest of society. For example, olive oil-water-bio-surfactants mixtures were never designed and studied, despite huge industrial potential (31). Fundamentally, biosensors involve bond disruption, reorientation, breaking, bond angle and bond energy to correlate and reveal mechanism for generating signal such as liquid crystals. It could be in a most conceptual manner such as intramolecular multiple force theory (IMMFT) to intuitively explain a sensing device that could excellently interpret surface and bulk phase dynamics responsible for microstructure designing depicted with SEM. In history of biosensor the IMMFT is a novel step forward and approaches for effective use. For example, around phosphate atom of EPC, three different alkyl chains with O atoms are fitted which cause different force centers within EPC (Figs.2 and 3). It sensed diffused hydrophilic response useful for emulsification or homogenous dispersion in bulk water phase and not moves to surface contrary to surfactants sensor such CTAB, CPC and CPB which accumulate at surface (32).

10. Experimental support

Experimental verifications could be made with surfactants and L-α-phosphatidylcholine (source egg yolk) by mixing with olive oil in 10^{-5}mol kg^{-1} with 2-10 mm kg^{-1} BS. Their densities, viscosity and surface tension with Survismeter measured of biophysical significance under sterilized condition. The EPC behaved as excellent emulsifier only because of many forces centers operational in developing interactions at separate points within a molecule. Hence it could not pushed to interface but remained suspended in hydrophilic water while the CPC, CPB and CTAB reduced almost 43% ST as they tend to surface and saturate the same by reducing surface energy or tension due to integrated hydrophobic CBF but the EPC does not have integrated CBF along the alkyl chain because of the O atoms are in chains. Hence comparatively the EPC behave as best emulsifier whiles the CPC, CPB and CTAB as best cationic surfactants. This observation is also supported by a SEM pattern, with stronger intermolecular forces with CTAB and olive oil which produced a higher compatibility and density (Fig. 2).

Surface tension

The surface tensions of BS-olive oil-water are lower than of the water by 1.5 mN m^{-1} except the EPC, with slightly lower values. With OOW, the higher surface forces than of the water are attributed to the stronger hydration spheres with the CPC, CPB and CTAB. The γ^0 are as EPC > CTAB > CPC > CPB (Table 1). The γ^0 data inferred a role of cohesive and adhesive forces due to activities in addition to electrostatic and Newtonian forces. The higher γ^0 value with the EPC exerted a stronger IMF with stronger hydrophobic-hydrophobic interactions of longer alkyl chain. The IMMFT model explained an action mechanism of the EPC due to multiple force centers such as two alkyl chain, oxygen atoms, PO_4^{-3} group and quaternary nitrogen atoms.

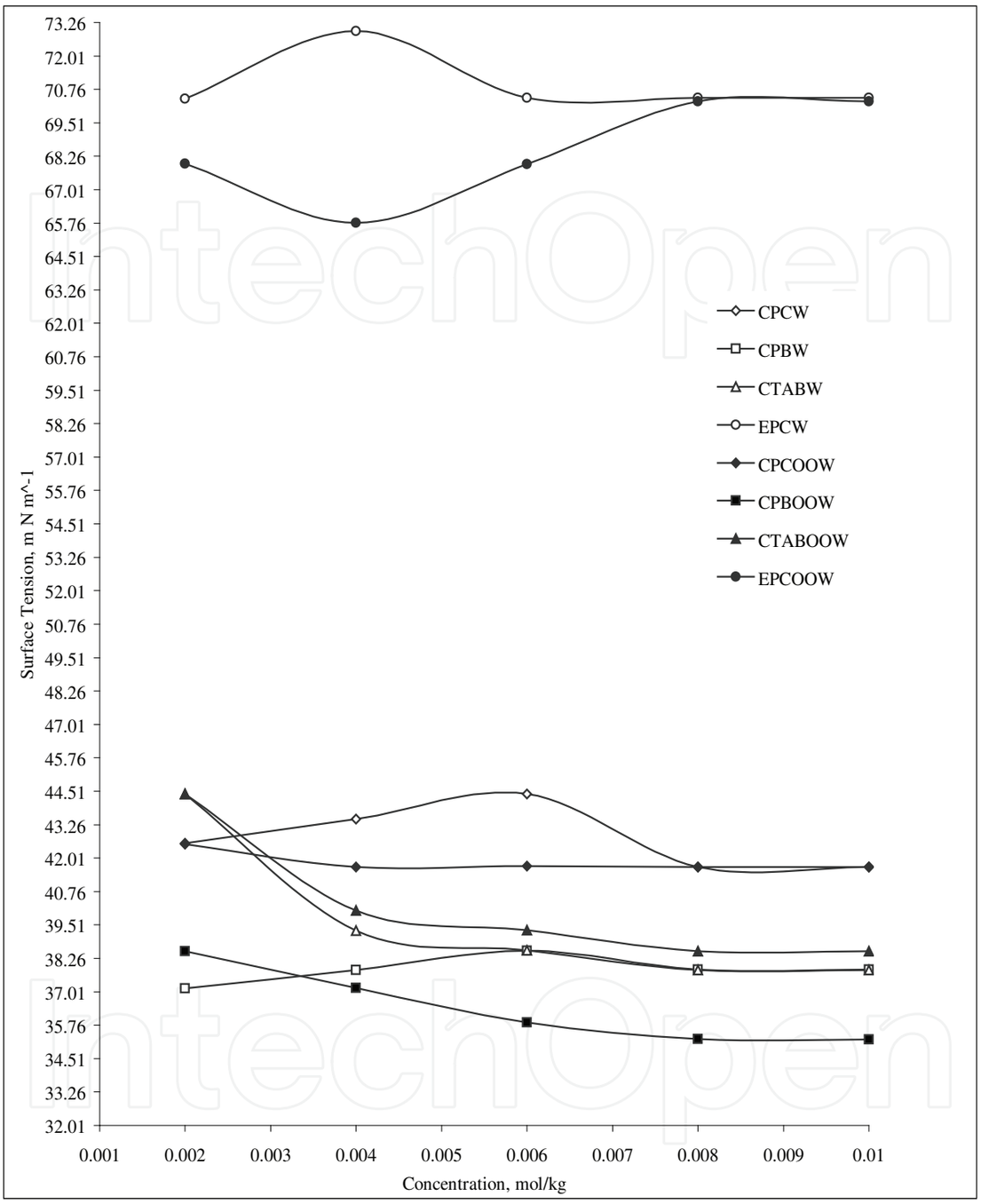


Fig. 2. A big gap in surface tension values of EPC and surfactants as physicochemical indicator where EPC and surfactants act as excellent biosensor in biofluids, bioemulsions, biocolloids and others. The biosensing mechanism is executed through stronger cohesive forces in case of the EPC while the weaker frictional forces with the surfactants. This defines a role of Friccohesity in successful and effective biosensors for based on fluid. The EPC works through hydrophilic and the surfactants through hydrophobic interactions based on IMMFT model. dynamics.

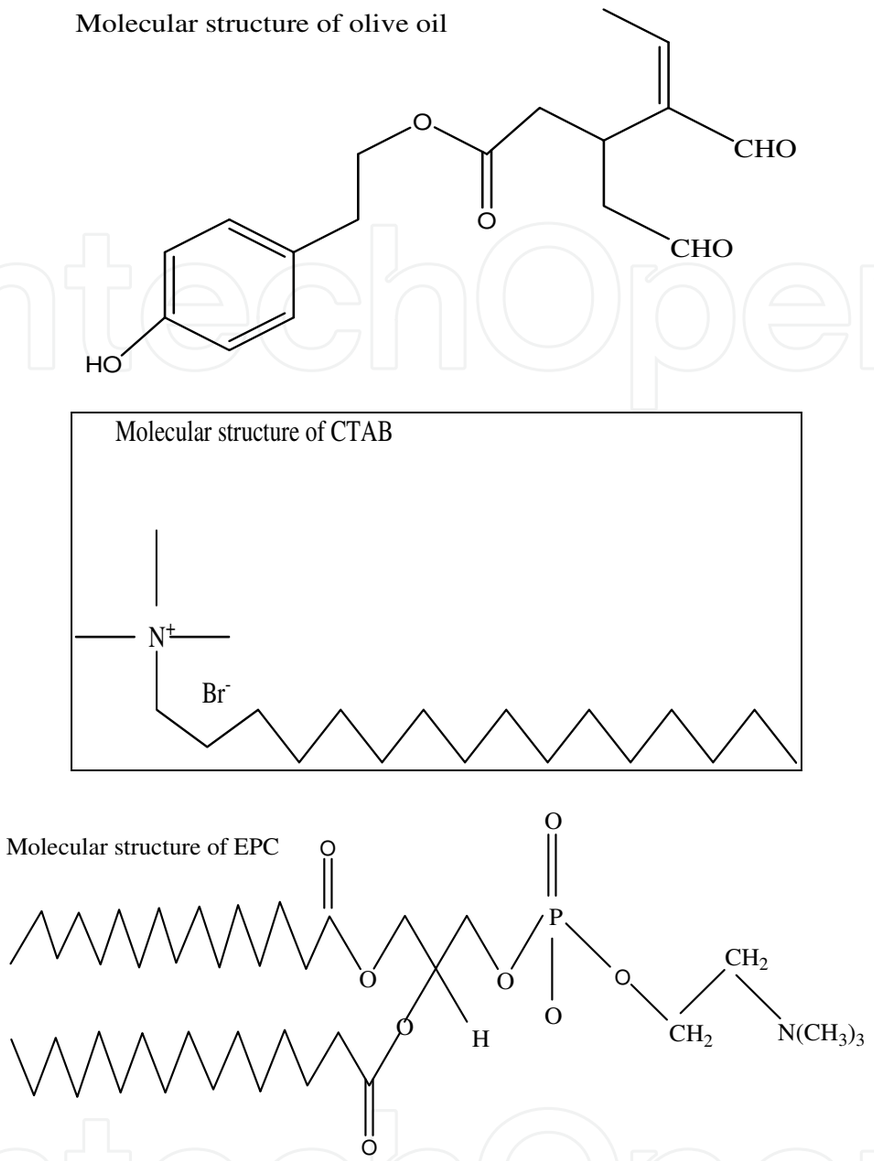


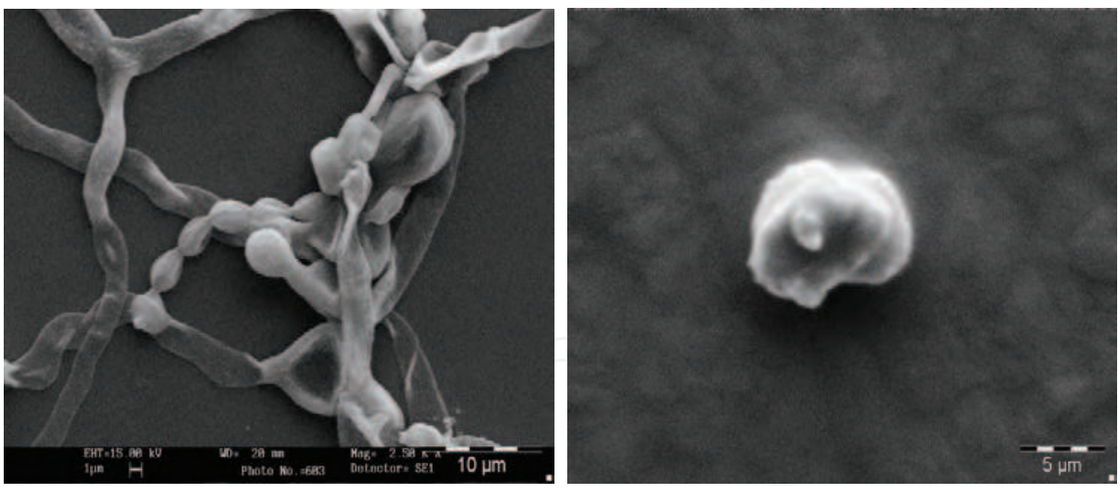
Fig. 3. Molecular structure of olive oil, CPC, CPB, CTAB and EPC.

The PO_4^{-3} group weakly disrupted the water, and highly asymmetricity in the EPC structure initiated the stronger cohesive forces. The higher entropic changes due to multiple force centers for interactions caused stronger hydrophobic-hydrophobic interactions. The IMMFT predicted that the EPC molecules are not able to disrupt the hydrogen bonded water and the multiple forces of electrostatical points EPC exert higher tension.

11. Hydrophobic and hydrophobic phenomenal support

For example, from 8 $mmkg^{-1}$ BS, the γ^0 is linear with no further change in surface forces, due to a complete kind of reorientation of water along little monomer formation (Fig. 3) which further increased with increasing concentration. The 8 $mmkg^{-1}$ BS, initiated micelles formation, and is a critical micelle concentration point (Figs 2 and 3). The SEM illustrated

dispersed structures of biosurfactants with higher intermolecular forces between them in aqueous olive oil mixtures (Fig.2). The IMMFT model excellently explained geometry of microstructures as a function of frictional and cohesive forces at multiple points, especially with the EPC The molecular dispersion have maximum surface forces but an olive oil brought them together causing intermolecular forces which reduced an exposed area with reduction surface tension as EPC > CTAB > CPC > CPB. Their comparative study illustrated higher surface tension and lowest dispersion with EPC (Fig. 2). The stronger intermolecular forces between the EPC-EPC with higher cohesive and adhesive forces in olive oil-water are responsible for such a behavior. The SEM illustrated comparatively uniform dispersion with the EPC with weaker Van der Waals and London dispersion forces and is attributed to IMMFT. Usually oil develops colloidal solution with diffuse interface forces while smaller biosurfactants are well defined hydrated units depicted by SEM. The biosurfactants breakdown the water structure while olive oil is not able to do so but it shifts the bulk structure of water around itself with a cage formation. The dispersion of the olive oil in water and of CPC, CPB, CTAB and EPC molecules with olive oil-water mixture is depicted by the SEM as CTAB > CPC > CPB > EPC > OOW (Fig. 2). Here, the SEM studies illustrate that the olive oil structure in water does not get disrupted due to stronger intermolecular forces but it remains in its original structure. The thread like structure inferred the C backbone of olive oil (Fig. 2). The EPC has caused least disruption into n-fragmentations due to stronger solute-solute interactions, results higher surface forces (Fig. 2). The CTAB though weakened the frictional forces but also caused some integrated or packed patches or the smaller globules which is dewetting depicted with SEM picture (Fig. 4). It describes the oil-water-surfactants mode.



[Olive oil-water] [CTAB with OOW]

Fig. 4. SEM pictures infer excellent biosensor activities of the biofluids.

12. Physicochemical significance

The McLachlan theory predicts that van der Waals attractions in media are weaker than in vacuum based on like dissolves like where the different types of atoms interact more weakly than identical types of atoms. In contrast to combinatorial rules or Slater-Kirkwood model that illustrated classical force fields which were supported by Jacob Israelachvili with

Intermolecular and surface forces model. The IMMFT model is advantageous by incorporating distribution of forces intramolecularly for better signal. The model of multiple force fields could be used for unfolding of protein structures, for example, energies of hydrogen bonds in protein engineering. The molecular biotics, fashionable configurations of atoms within spatial framework of covalent bonds, for example proteins, amino acid with intradisciplinary molecular structures like organic, semi-organic, complex, supramolecular prototypes activated chip. These perform several functions where Schrödinger quantum mechanics and wave mechanism of energy distribution occurs. The theology of scientific up gradations on ionic to molecular coordination have now at center stage not because of nanotechnology but because of molecular potential to resolve various complicated issues of the matters. In this context, the IMMFT model is most suitable and a step forwards for resolving better understanding of the giants and supamolecular structures.

13. SEM correlation

Conclusively, a correlation between physicochemical properties and SEM microstructures is noted in case of the EPC, a very common ingredient of the food digestion process. A fundamental difference in interacting behaviors in EPC and other surfactants CPC, CPB and CTAB is of surface activities. With EPC due to IMMFT the EPC does not pushed to surface and could not reduce surface tension as compared to others which reduce about 43 %. Since they saturate the surface due to stronger CBF but EPC is missing CBF. So EPC is a best emulsifier while they CPC, CVPB and CTAB are best surfactant. With EPC three alkyl chain surround phosphate with steric and induction effects due to CBF and each alkyl has double bond with sp^2 configuration, also contribute to emulsification with negligible surface excess concentration. Hence IMMFT is excellent model to structurally explain molecular forces responsible for emulsification action of the EPC as it has not largely reduced surface tension by not ending towards interface. Contrary to EPC, the CPC, CPB and CTAB reduced surface tension more than 43% with higher surface excess concentration and comparatively stronger hydrophobic interaction than those of the hydrophilic. The EPC is as excellent emulsifier only because of the many forces centers operation in developing interactions within single EPC molecule and is not pushed to interface but remained suspended in hydrophilic. Hence comparatively the EPC behave as best emulsifier whiles the others as best cationic surfactants. The slopes values with EPC are lower than those of CPC, CPB and CTAB because the EPC is emulsified or dispersed homogenously in bulk water phase. So the EPC does not move towards surface with increment in its concentration contrary to CTAB, CPC and CPB which tend towards surface and get accumulated there on that seriously affect the surface tension. Higher concentration accumulation on surface need higher work to be done and hence it strongly weakens tension. Thus the slopes with CPC, CPB and CTAB concentrations the higher reduction in surface tension is required as compared to the EPC. Hence the IMMFT explained the maximum dissolution with EPC

14. Novel molecules

Few new and novel molecules such as 2,4,6 tridiethymalonate-triazine (2,4,6 TDEMTA) 1st (G_1) and 2,4,6 hexadiethylmalonate-triazine (2,4,6 HDEMTA) 2nd (G_2) tier dendrimers as efficient biosensors were developed [synthetic] and found with exceptionally high biosensing activities due to octopus like geometry with $7.12x10^{145}$k J $mol^{-1}K^{-1}$ frequency factor range estimated with Arrhenius equation. Their higher surface area with significant

void spaces has many channels and cavities with an ability to trap foreign material in medical sciences, drug delivery systems, in biomedical, biophysical and biochemical fields. Their biosensing activities A′ and activation energy E′ calculated from [η] vs 1/T with [η] = log A′-(E′/2.303 RT) Arrhenius equation log. E′/2.303 are slope and R gas constant (8.314 J $mol^{-1}K^{-1}$).

14.1 Limiting viscosity η^0

Their biosensing activities A′ and activation energy E′ may monitor branching and π conjugation where both the factors contribute to modulate intermolecular forces. The η^0 values define state of electrostatic forces for shape and hydrodynamic structure a most prominent requirement for biosensor. The G_2 structure with larger π conjugation numbers develop hydrogen bonding among branches with higher molar volume. Intrinsic viscosity B is associated to the shape and size and is very low whose value indicates heteromolecular forces with medium and rotational motions. As the viscosity is an arrangement of intermolecular forces to get oriented to interact through certain activation energy. In general, the dendrimers show higher viscosities than of the water because higher activation energy E′ and longer time is required for their reorientation. For example, activation energy of G_1 is 854.39 kJ $mol^{-1}K^{-1}$ which is because unexpectedly very high rotations and reorientations. These forces increase many times for G_2 with greater rotational and electronic rearrangement due to greater entropy. The B values for G_2 are slightly higher than those of the G_1 with a similar interacting dynamics where more branching develops higher hydrodynamic volume. Several theories such as Mark-Houwink-Sakurada Equation structurally illustrate action mechanism of biosensors in context of degree polymerization as 6 and 2 times, respectively.

15. Binding volume (v_m) impacts

Boundary is to be determined that where from a restriction on binding volume becomes effective when the biosensor undergoes activities. So far no concrete studies are cited to define a critical point drawing a line for restriction to be effective or not, and the solvents also contribute. For example, the water is a poor solvent for macromolecules (2), and such data become highly relevant for G_2 type biosensors where chain length is 2 times higher than of G_1 type biosensor. The v_m values for G_2 are higher that prove stronger biosensing action. Newly developed biosensors must be stable at workable temperatures. In this context their temperature stability is studied with thermal gravimetric analysis (TGA) as their disintegration ($\partial m/\partial T$, g/Kelvin or g K^{-1}) during biosensing activities would defeat the purpose to use them as biosensor.

16. Thermal stability of new materials

This technique predicts a weight loss (g min^{-1}) on thermal decomposition or disintegration ($\partial m/\partial T$) that infers their thermal stability where compositional or thermally induced transitions do not disrupt original biosensor structure on a pattern of the catalyst. Their thermogramme must be a straight line with time with respect to variable, may be temperature of the process or the pressure or the polarity of the medium. The G_1 and G_2 both have marked slight decomposition from 80 to 120°C due to loss of weakly bound water with @ 2.4 g min^{-1}. The 2nd small zone noted around 250-260°C, which confirmed higher temperature stability of the targeted biosensors. At 280-360°C a sharp weight loss with 22.5

g min^{-1} was observed. The TDEMTA is slightly complicated decomposed with several rates. The dendrimer shows 22% weight loss @ 2 g min^{-1} and 19.63% weight loss @ 1.2 g min^{-1}at 620°C and 800°C respectively. Hence the structure of dendrimer comparatively resists temperature change. The thermogramme shows least loss at around 80-100°C with almost a stable curve. The dendrimer consists 3 polar zones with lone pair of electron on nitrogen; also the π conjugation develops polarity responsible for binding of the polar molecules such as water and ethanol. At 250°C, a sharp weight loss @ 5.8 g min^{-1} with molecular reorientation infers weakening of hydrogen-bonded structure. The critical changes due to thermal energy were observed after 320°C, may be, due to breaking of branches but at about 420 and 450°C. The G_2 (2, 4, 6 HDEMTA) shows 11 thermal decomposition zones with different rates with sequence of physical transformation and breaking of bonds. The G_2 shows comparatively higher thermal stability than those of G_1 with weight loss @ 0.05 g min^{-1} from 50 to 80°C. At 340.82, 382.45°C, the 3rd and 4th reactive zones infer elimination of weakly bonded and hydrogen bonded molecules with 39.6 % weight loss @ 2.5 and 4.0 g min^{-1} as it is highly branched with a web like structure. The G_2 with 12 terminal branches radiated from a central hub and the zones at around 450 and 560°C demonstrate breaking of branches with decomposition of 62.05% weight loss. Physicochemical, spectroscopic and thermal decomposition studies inferred similarity in structures of 1st and 2nd tier dendrimers except degree of polymerization 2 and 6 times, respectively. It infers that larger branching that inhibits the IMMFT linkage for biosensing linkages due to more stability. The G_1 depicted below.

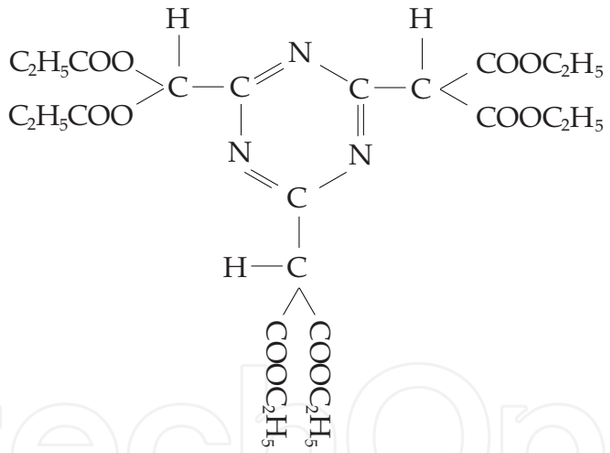


Fig. 5. 2,4,6 TDEMTA G_1, a white solid washed with water dried at NTP stored in P2O5 filled desiccator

16.1 IMMFT

Figs. 5 and 6 depicts most effective and befitting model fitted in IMMFT concept for working as excellent biosensors due to multifunctional force centers that monitor biosensing activities and interacting energies. Each force centre has individual electrostatic force (ESF) confined and aligned in A most distributive manner based on Boltzmann energy distribution concept. The ESF is defined with densities. Similarly the biosensor develop cumulative intermolecular force (IMF) based on ESF and also due to covalent bonding forces (CBF). The CBF deals with viscosities. For example, the G_1 and G_2 densities and viscosities are measured with Antaan Paar densitometer and Survismeter (Calibration no.

0607582/1.01/C-0395, NPL, Govt. of India) respectively at NTP. Their data are given in Tables 1 and 2. Further excellent newly developed conceptual parameter named as friccohesity could serve as a most useful data to illustrate dynamic movements of the dendrimers during operational course

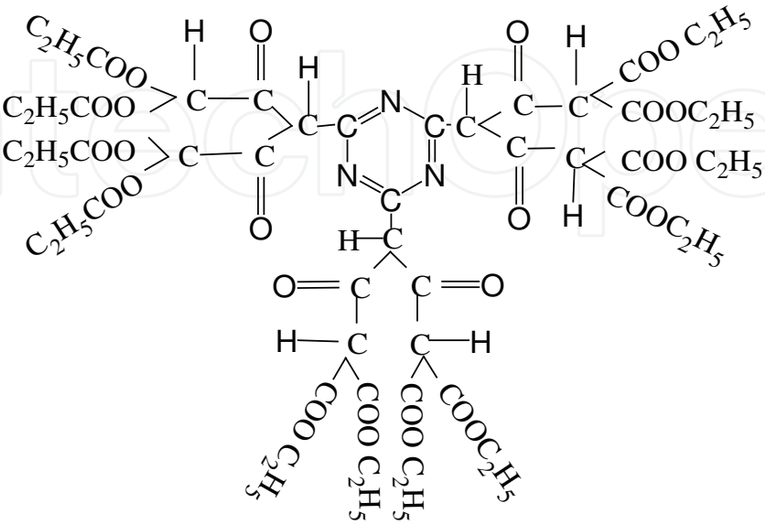


Fig. 6. The 2,4,6 HDEMTA G_2 tier dendrimers, white precipitate filtered, washed with warm water (Singh et al, Synthetic Commun 38, 2857, 2008)

16.2 Data support

dendrimers	Temperature (K)	ρ^0	S_d	S_d^*
G_1	298.15	0.9967	0.1948	-12.9449
G_1	303.15	0.9914	0.1238	-6.5065
G_2	298.15	0.99684	0.1947	-12.9449
G_2	303.15	0.9915	0.1238	-6.5065

Table 1. Limiting densities $\rho^0/10^3$kg m^{-3}, 1st and 2nd degree slopes, $S_d/10^3$kg^2 m^{-3}mol^{-1} and $S_d^*/10^3$kg^4 m^{-3}mol^{-3}, on regression densities against c%.

dendrimers	Temperature (K)	B	D	D′
G_1	298.15	45.3607	- 13623.30	947527.20
G_1	303.15	- 6.4835	2357.29	-170666.91
G_2	298.15	45.3318	-13596.20	945149.85
G_2 dendrimer	303.15	-6.34206	2306.44	-165958.33

Table 2. Intrinsic viscosity B/0.1 kg mol^{-1}, slopes D/(0.1 kg mol^{-1})^2 and D′/(0.1 kg mol^{-1})^4.

17. Novel biocompatibility for new biosensor materials development

Historically, polyvinylpyrrolidone (PVP) in 2nd world war, was used as artificial blood plasma as anticoagulant to compensate shortage of the blood due to infinite war causalities.

Since the PVP molecule is sizable and was used to develop melamine-formaldehyde-polyvinylpyrrolidone (MFP) resin with excellent biosensor activities and porous structure to perform several activities such immobilization of the bacterial growth, adsorption of toxic metal, alkaloids, narcotic drug, protein unfolding, biomacromolecular engineering and others. Its microstructure obtained with scattering electron microscopy in depicted in Fig. 7 which is highly porous with sizable void spaces. Dispersive and adsorptive activities of the MFP biosensor were studied by blending it with glycerol, a biocompatible molecule and an impact is also depicted in Fig. 7. The glycerol is trapped and equally distributed as per Boltzmann distribution law where the friccohesity (equation 3) resolves the thermodynamic assistance to distribution as its motions are developed due to concentration gradients.

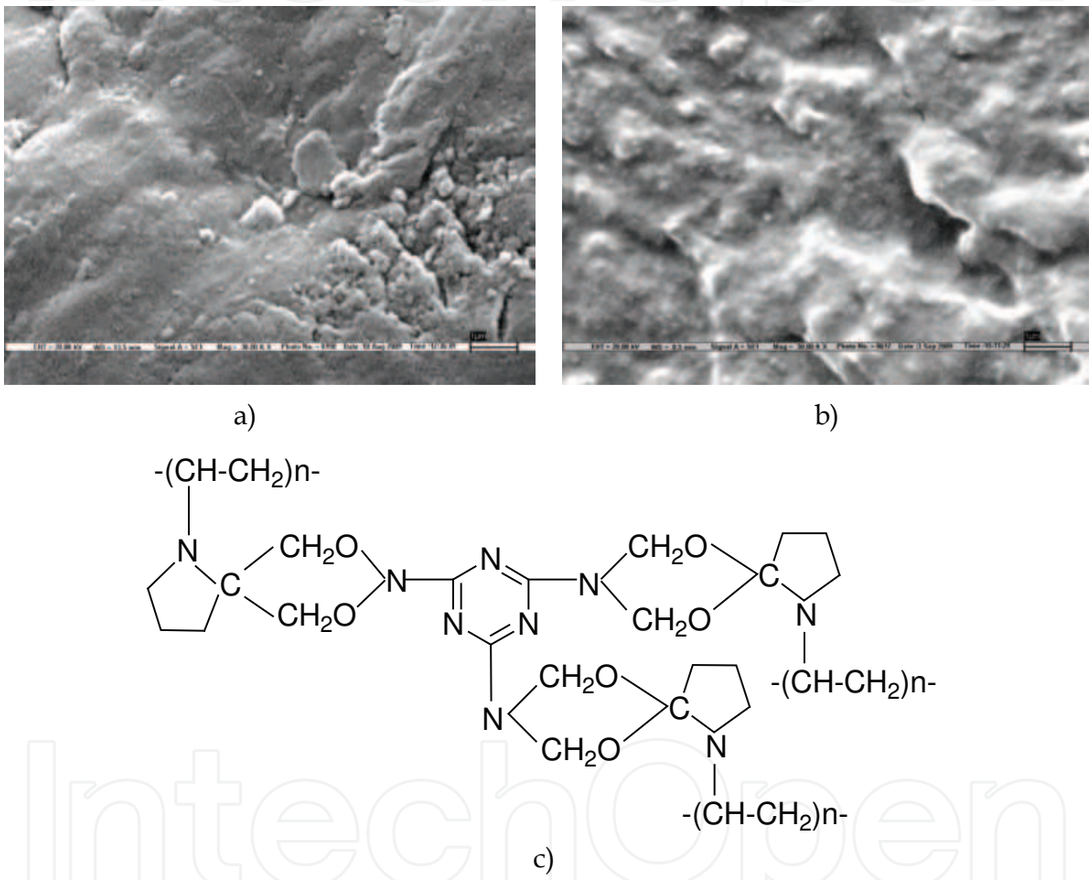
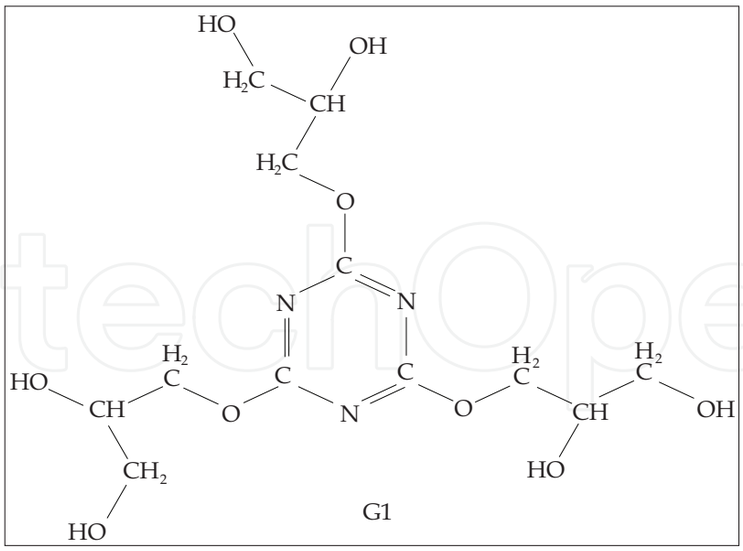


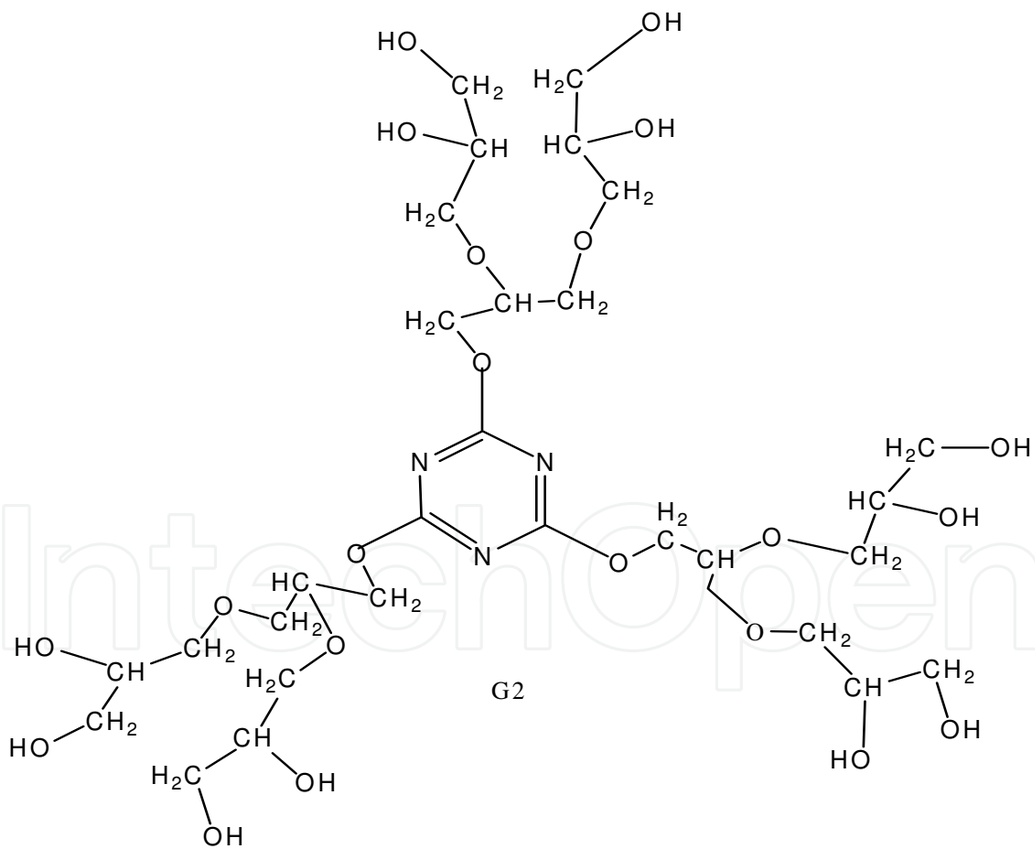
Fig. 7. a) MFP; b) MFP + glycerol; c) Molecular structure of MFP, core is belongs to melamine bridged via CH_2O to PVP units (Singh et al, J. Appl. Polym. Sci. 114, 1870, 2009)

18. Biocompatibility essential condition

The biocompatibility of newly developed molecules to use them as biosensor is essential condition hence few molecules illustrated in Figs. 8a and b are developed. It could be achieved when the highly biocompatible molecules are used in their preparation. The 2,4,6 triglcerate triazine, Tri (2, 4, 6) glycerate triazine (TTGTA)biosensor which have been prepared with glycerol a most biocompatible molecule and widely used in biochemical, biophysical, and essential part of the oils and fats.



a)



b)

Fig. 8. a) 2, 4, 6 triglcerate triazine (TGTA); b) Tri (2, 4, 6) glycerate triazine (TTGTA) biosensor dendrimer with anticancer mechanism and drug carrier Branching act as tentacles to rupture cancerous cells and cutoff food supply from normal cells

19. Supramolecular biosensor or metallic biosensor

Silicon is well known and established biocompatible metal and has been used in several surgery, implants and artificial catheter preparation. Thus Poly-N-vinylpyrrolidone oximo-L-Valyl-Siliconate, a supramolecular biosensor, was prepared using silicic acid as core unit with the PVP and amino acid. The structure is depicted in Fig. 9. It has wider intramolecular voids to bioremediate toxic metals such as Hg, Cd and intrafacial interactions.

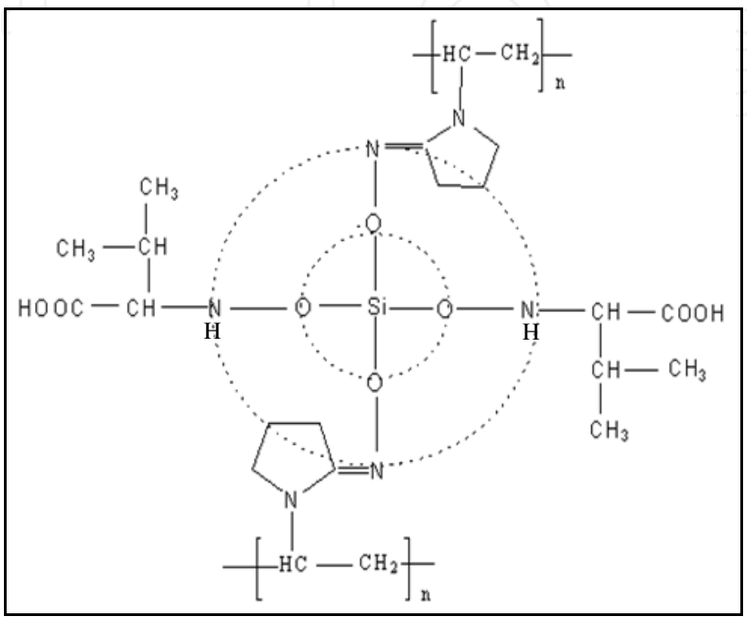


Fig. 9. Poly-N-vinyl pyrrolidone oximo-L-Valyl-Siliconate (Singh et al, Bull. Korean Chem. Soc. 31, 1869, 2010)

20. Tentropy

In general, the dendrimers do have effective tentacles which have effective movements and entropy induced changes. Fundamentally any effective change that cause a dent in particular dimension with effective friccohesity incorporating cohesive and frictional forces associated with dynamic motions is noted as tentropy. This an in significant feature of the biosensors that lead the message to viable mode and to amply so that a minor change is measurable and noticed in case of some critical turns. Since friccohesity is a turn force theory (TFT) or dual force theory (DFT) hence such changes are most desired to be measured in case of the biosensor sciences. The tentropy is most desired parameter with molecules such as TTGTA.

21. Biosensor science

Truly the biosensor is a most fabulous science and closely associated with thermodynamics and biothermodynamics. Its friccohesity could offer a most relevant and legitimate information about the signal sensing which is reported in terms of the chemical change without disrupting original structure of the biosensor except moderate and reversible reorientation and motions to suit the signal to be transported and reached to a measuring devices. Thus the electrochemical signal noted as force is depicted with equation of the net

force theory where the IMMFT is really immensely related to inner and outer correlation of the surface and bulk phase structure changes of the biosensors. Such forces could trap with equation 4 which newly formulated to study weaker and molecular forces in mixtures of different polarity and thermodynamic changes.

$$F_{nimf} = F_w - F_{pm} = \frac{1}{4\pi\varepsilon_0}\left[\frac{q_w^- q_w^+}{r_w^2} - \frac{q_{pm}^- q_{pm}^+}{r_{pm}^2}\right] \quad (4)$$

The F_{nimf} is net intermolecular force, F_w and F_{pm} as water and polar molecular forces, q denotes their respective electrostatic poles with r as their distances, the ε_0 medium permittivity. A net intermolecular force is responsible to generate the signal where electronic charge conduction moves over atoms due to atomic combinations. In general, the molecules such as oils also develop electrostatic potential ($-e^2/r$) and kinetic energy ($p^2/2m$) in contact of the $H^{\delta+}$-$O^{2\delta-}$-$H^{\delta+}$, a polar water molecule. It generates weaker Vander Waals and Lennard Jones Potential. The molecular forces, F along several motions, orientations with definite cohesive forces which are highly useful for acoustics type biosensors and useful for structural protein unfolding as an excellent model of molecular motions. In general, the newly developed biosensors have been found in a nanorange depicted in Fig. 10.

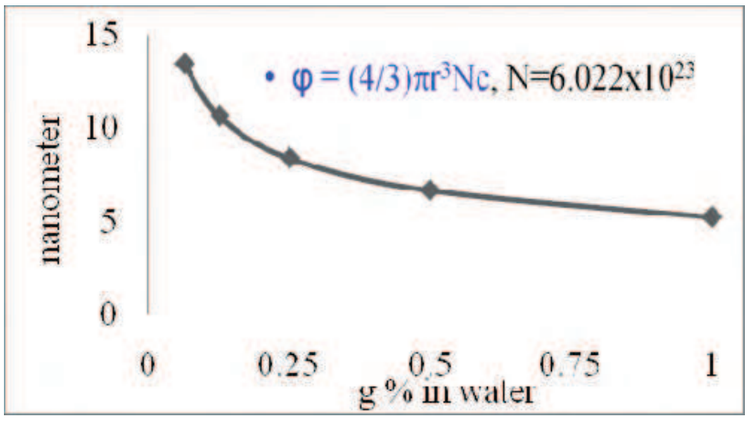


Fig. 10. In general, molecular size of the newly prepared biosensor

The φ is volume fraction, N_c or N Avogadro number, r radii of the molecule.

22. Induced electronegativity

When polar molecule is mixed with partially polar molecules the electronegativity is induced that enhanced higher wetting as compared non-induced electronegativity. The equation 7 with electrostatic potential ($-e^2/r$) of the water and kinetic energy ($p^2/2m$) of organic molecules caused stronger interaction with stronger CBF, Van der Waals and Lennard Jones Potential. A hydrophobicity of organic molecules could be noted that could also cause several motions, orientations and bond stretching with shear stress and strain. Pauling described interaction due to electronegativities as in equation given below.

$$\chi_A - \chi_B = \frac{1}{eV^{1/2}}\sqrt{E_d(AB) - \left[\frac{E_d(AA) + E_d(BB)}{2}\right]}$$

The E_d is dissociation energy, the χ_A and χ_B are electronegativities of A-B and A-A and B-B type molecules such water and p-cresol with a mixing with rise in temperature. Oscosurvismeter could also be noted as an effective instrument to deal with such molecules as it tracks osmotic pressure, conductance, surface tension and viscosity together. Also econoburette for simple titrations could be noted as indicators or sensor for indicating pollutants in water after doing titrations with this.

23. Sustainable tech for physicochemical characterization of biosensor: Borosil Mansingh Survismeter

Architectural molecules are the most sensitive and befitting to act as ideal biosensor with 100% activities which are altogether different as compared to ideal molecule with 0% activities. Thermodynamically $\Delta G_{biosensor} < 0 < \Delta G_{ideal}$ relationship exits with $\Delta S_{biosensor} > 0 \neq \Delta S_{ideal}$. The ΔG and ΔS stand for Gibbs free energy and entropy respectively. In general ideal systems are away from thermodynamic systems due to an absence of interactions with them that generate and design interacting and reacting molecular materials analyzed with green analytical device noted as Borosil mansingh survismeter. It is most sensitive to elucidate structural and tentropic changes associated with systems. The biosensor are covered under interacting and reacting molecular materials (IRMM) developed as academically and industrially functional materials (AIFM) and currently cover wider industrial and academic horizons of research and application. Two categories of materials transparently stand namely (a) thermodynamically, optically, electrically, chemically interacting molecular materials and (b) thermodynamically, electrically, optically, chemically reacting molecular materials. Both interaction and reacting molecular materials (IRMM) require accurate and précised sustainable trusted analytical devices (STAD) for trapping, capturing, modernizing, manipulating, manifolding molecular potential for developing new and novel materials. Differentiating and integrating profile (DAIP) of interacting, reacting and allied properties (IRAP) of molecular materials under material sciences need STAD for prerequisite experimental analysis (PREA) for efficient quality control, quality formulations and assurance, testing, calibration and similar others of industrially materials with certain physicochemical indicators (PCI) with interesting physicochemics and molionic materials.

In this context, surface tension, interfacial tension wetting coefficient, viscosity and Friccohesity as useful PCI offer ample opportunities in checking potential of biosensor including cosmetics, petroleum & oils, polymer and textile, paper pulp, soap & detergent, liquid soaps, drug designing, molecular weight determinations, water binding, holding, molecular aggregations, polymerization, dissociations, tiers are regularly and routinely analyzed. Frequent laboratory experiments for such purposes requires manifolds resources, time, skilled manpower, infrastructure and other accessories are urgently used where individual devices are failed, discarded redundant, beyond reach, troublesome, tiring, accessible to accidents and cost intensive. Borosil Mansingh Survismeter, being a green science STAD measures abovementioned PCI together with 98% saving of experimental resources, infrastructure and skilled manpower, for Interacting and Reacting Molecular Materials. It lays down a foundation of new fundamental chemistry noted as Friccochemistry and most suitable for giants, supramolecular, dendrimers and similar others. The friccochemistry defines a fundamental science responsible and operation for creating vacancies of PCI and IMMFT simulations, combinations and synergies. For example, the thermodynamics and simulations of biphasic systems do cause a practical

potential for extractions, salting out or in phenomenon for recovery of target drug, proteins or other molecules. Novel sciences are urgently required for safer and sustainable technique to detect extra elements present in biosensor molecules as the elements such as halides (chloride, bromide and iodide), nitrogen and sulphur do induce viable sensing electrostatic forces for enabling strength to the functional groups. For such identifications Safer Technique for Sustainable Sodium Extract Preparation for Extra Elements Detection listed as Nonbreakable Sodium Ignition Apparatus (NOSIA) was developed and used for wider experimental determinations.

It becomes a milestone in exponentiation and boosting up science and research on biosensors to open new gateways and explore newer opportunities. Especially chemical interaction and interfacing (CII) with several interdisciplinary for learning and understanding complex through laboratory experiments. The surface tension and viscosity measurements need cost intensive Tensiometer and Brookfield viscometer which he could not afford. Work on biosensors associated with protein unfolding dynamics needs accurate and précised surface tension and viscosity data. For few experiments looking for some novel feature of fluid dynamics but suddenly experimental failed to produce reliable results and idea was revised and experimented several times but there was no outcome despite best efforts and economics. The failure led to a novel concept of dealing surface dynamics and viscous features of BSA protein aqueous solutions. There was a historic moment when a failure diverted attention to another hidden science of highest potential of measuring surface tension and viscosity together. Borosil Mansingh Survismeter Singapore Patent no. 126089, New Green Analytical Tech Laboratory Equipment is easily affordable within ordinary experimental conditions. Borosil Mansingh Survismeter is new and novel breakthrough in laboratory instrument with wider analytical potential for quality control and formulations in material applied sciences. It has unique cutting edge and salient facilities and feature based on n-in-one based on "On and Off" or 0 and 1" circuitry functional loops.

- Fundamentally, it measures surface tension, interfacial tension, wetting coefficient, viscosity and Friccohesity together of aqueous, non-aqueous, aprotic dipolar, polar, protic polar and non-polar solvents and mixtures.
- The absolute and relative parameters are measured with 95.5% CV (confidence variance).
- It works on theory of R4M4 of materials and methods with highly précised and accurate experimental results along 100% inhibition of polluting discharges in experimental determinations.
- The parameters measured with it are highly significant for quality analysis of pharmaceuticals, biochemicals, cosmetics, agrochemicals, food and beverages, petroleum and oils, polymer and proteins, sol gels, soaps and detergents, inks, colloids, emulsion technology, cutting oils, lubricating, viscous, moderately viscous and highly viscous materials.
- It is especially useful for characterizing liquid mixtures of biopolymers, spuramolecular chemistry, biotechnological processes and molecular interacting engineering of the biomolecular devices, tracking interacting molecular forces, water binding capacities and structural changes during processes.
- It is an asset for volatile, moderately and highly volatile liquids and mixtures, volatile organic compounds, flammable liquids, carcinogenic materials as samples are completely jacketed for surface tension determinations.

Environmental friendly:

- Currently, environmental and user safeties have been in focus and urgent needs, so steps are being initiated to implement innovative ideas in experimental devices to cop up and to save recurring in laboratory practices.
- The Survismeter is a most recent practical solution to apply multifaceted, multipurpose, multidimensional, fast track and most inspiring science.
- The Survismeter is a most defective analytical tool for industries that excellently enrich a spirit of research initiatives and to commercialize innovative ideas to benefit the society at large.
- Historically, Inventor Industry Interaction (I_3) has been on cards for time immemorial to resolve the analytical problems in material sciences.
- Since its inception the students and scientists are fascinated to apply it in various fields of applied sciences like cosmetics, sol gels, drug designing, pesticides, insecticides, syrups, coatings etc.
- In general, syllabi curricula of graduate and postgraduate classes of chemistry/chemical technology, pharmacy, physical sciences, do have experimental provisions for measuring surface tension, interfacial tension, molecular surface areas, wetting coefficient and viscosity.
- It saves electricity, water, manpower, chemicals, laboratory infrastructure, glass materials, glassblowing gases LPG, oxygen and others by 97% along 98% reduction in dissipation of heat contents.
- The equipment works on principle of pressure gradients generated with help of "Cutting Off and On Devices" in form of continuum and non-continuum models of fluid dynamics.
- The survismeter is most excellent model for study of Liquid-Liquid Interfaces (LLI) of two immiscible solvents. In general, homogenous liquid mixtures of components i and j do follow $dG_{ij} = 0$ where both i and j are fully dissolved and attain equilibrium with zero value of the Gibbs free energy change (dG_{ij}).

Asset for Physical, chemical biophysical, pharmaceutical, biotechnological sciences laboratories, for measuring surface tension, surface excess concentration, molecular surface area, interfacial tension and viscosities of samples with single unit. Since centuries, these parameters are being measured individually with much experimental resources and laboratory infrastructures.

- The Survismeter has reduced resources including support materials like glass, blowing gases, manpower, laboratory space, electricity, water, chemicals, by 97%. A statistical analysis of the resources being used for measuring surface tension, interfacial tension and viscosity in 219 Indian Universities was made and noted about 98% saving if Survismeter is used in place of individual apparatuses.
- Apart from Universities and colleges, characterization of materials for coating, polishing, cosmetics, VOC, thinners, ethers, acetone, hexane, ethanol, benzene, CCl_4, printing, calendaring, dry cleaning, textile cleaning-drying, interior decorations, fumigation, sprayants.
- Generally nonideal systems of surfactants industrially act as emulsifier, defoaming agents, spreaders, special detergents, household and industrial detergents, liquid detergent, industrial application-textile, agriculture, pulp and paper, etc, scouring agent, emulsion polymerization, dispersant.

- It is safe in handling, sample loading with no hazards and no discharge of polluting fumes/materials. It occupies minimum laboratory infrastructure.

The Survismeter determines Gibbs adsorption isotherm (surface area Γ, mol m^{-2}), wetting coefficient of phase forming liquids with high accuracy & precision, and is multipurpose and fascinating. The surface and interfacial tensions are beneficial to surfactants, waxes, inks, soaps-detergents, cosmetics, pharmaceutics, oils-petroleum, sol-gels, emulsions polymers, solvents, supercritical solvent, lubricants, textile and others. The equation given below explains wetting coefficient of biosensor.

$$\frac{\eta h^2}{t} = \left(\frac{\eta h^2}{t}\right)^0 + A\gamma$$

The mansingh equation given under also defines Brownian and Boltzmann energy distribution of biosensors.

$$\sigma = \sigma_0\left[\left(\frac{t}{t_0} \pm \frac{B}{t}\right)\left(\frac{n}{n_0} \pm 0.0012(1-\rho)\right)\right]$$

The B/t and 0.0012(1-ρ) range from 10^{-7} to 10^{-6}, and are omitted then equation becomes as

$$\sigma = \sigma_0\left[\left(\frac{t}{t_0}\right)\left(\frac{n}{n_0}\right)\right]$$

$$\text{or } \sigma = \sigma_0\left[\left(\frac{tn}{t_0 n_0}\right)\right]$$

$$\text{or } \sigma = \frac{\sigma_0}{t_0 n_0}\left[(tn)\right]$$

Putting $\frac{\sigma_0}{t_0 n_0} = M_c$ then $\sigma = M_c\left[(tn)\right]$, the M_c is Mansingh constant which illustrate activity coefficient of the biosensor under defined physicochemical constants. The mansingh constant is a vital tool of friccochemistry applications, efficient and reliable characterizations and categorization of the biosensors.

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This book is a collection of contributions from leading specialists on the topic of biosensors for health, environment and biosecurity. It is divided into three sections with headings of current trends and developments; materials design and developments; and detection and monitoring. In the section on current trends and developments, topics such as biosensor applications for environmental and water monitoring, agro-industry applications, and trends in the detection of nerve agents and pesticides are discussed. The section on materials design and developments deals with topics on new materials for biosensor construction, polymer-based microsystems, silicon and silicon-related surfaces for biosensor applications, including hybrid film biosensor systems. Finally, in the detection and monitoring section, the specific topics covered deal with enzyme-based biosensors for phenol detection, ultra-sensitive fluorescence sensors, the determination of biochemical oxygen demand, and sensors for pharmaceutical and environmental analysis.

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