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IRMA NEWS

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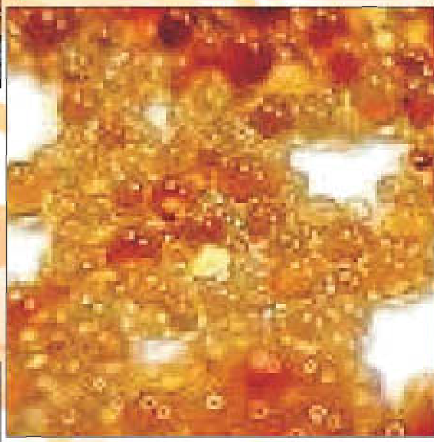

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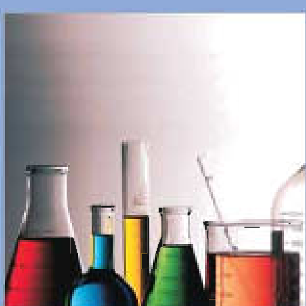

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From The President's Desk

Dear IRMA Members,

All good things come to an end in life and so also has my presidentship. Two years have whizzed by so quickly like the snap of fingers or a blink of an eye. Much has been achieved and much remained which will be taken care of by my successor Mr. Ashok Goklani.

In last two years, we could start a technical library, held a workshop and a seminar, published two technical books. Also, we gave a new face to IRMA News and first time in the history of this organisation, we have successfully started a new region in south based in Hyderabad, with strength of 32 members. We could add a net growth of 56 members which makes IRMA a much bigger and stronger family.

We have started a new concept of "VzNG" or "Vision for Next Generation" wherein "College of Presidents" ie all past presidents, all incoming presidents in the line and president have started meeting to give shape to IRMA with a vision to have a proper silver jubilee in short term, a decade's planning in medium term and planning of golden jubilee in long term. Thus, future of IRMA will be bright.

As President of IRMA, I have learnt a lot and experienced a lot. I have gained many new friends and strengthened my friendship with old friends. Which organisation, friends, will give you an opportunity to come close and have goodwill even with your competitors and yet protect mutual interest? Friends, this is our IRMA. If all of you want your outgoing President's message in one sentence , I would say that "Please maintain same atmosphere in our IRMA and our IRMA will have a bright future".

All this makes me express my deep sense of gratitude to all MC members and all IRMA members for their support all along. I wish incoming President Mr. Ashok Goklani all the best.

Ballal Chandrachud
President

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Bio-based Polymers for Coatings

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The utilization of renewable resources in energy and material applications is receiving increasing attention in both industrial and academic settings, due to concerns regarding environmental sustainability. Nowadays, most commercially available polymers are derived from non-renewable resources and account worldwide for approximately 7% of all oil and gas used. With the continuous depletion of fossil oils, dramatic fluctuations in the price of oil and environmental concerns, there is an urgent need to develop polymeric materials from renewable resources.

The most widely used renewable raw materials include vegetable oils, polysaccharides (mainly cellulose and starch), wood and proteins. Vegetable oils represent promising route to renewable chemicals and polymers due to their ready availability, inherent biodegradability and low toxicity. In fact, industrial uses consumed 15% of all soybean oil from 2001 to 2005. Vegetable oils have been used in paints and coatings for centuries, because the unsaturated oils can oligomerize or polymerize when exposed to the oxygen in air.[1]

The current difficulties with some of the biobased polymers in commercial application are mainly due to their inferior mechanical and thermophysical properties in comparison with the conventional petroleum-based polymers that are intended to replace. Therefore, it is currently difficult to completely replace petroleum-based polymer materials for nothing more than the necessary mechanical and thermophysical properties. However, it is not necessary to completely replace petroleum-based polymer materials immediately. As a result, a good solution combines different features and benefits of both synthetic and biobased materials to reduce the dependence on petroleum. Consequently, biobased materials were used to partly replace thermosetting resins, such as epoxy resin and unsaturated polyester. At present, of all the available plant oils appears to be the most attractive alternative resource for biobased materials because of its low-price and abundant supply.[2]

During the last decade, a variety of vegetable oil-based polymeric systems have been developed. Unmodified vegetable oils have been used to prepare biorenewable polymers by thermal or cationic polymerization methods, taking advantage of the carbon-carbon double bonds in the fatty acid chains. Modified vegetable oils with acrylic double bonds exhibit higher reactivities and can undergo free radical polymerization to afford thermosets with good thermal and mechanical properties. Vegetable oil-based polyols are another promising monomer, which can react with diisocyanates to afford polyurethane elastomers, as well as water-borne polyurethane dispersions, which have various applications in foams, coatings, and adhesives.[3]

The structures of vegetable oils

Vegetable oils are vital biorenewable resources extracted from various plants and are normally named by their biological source. Chemically, vegetable oils consist of mainly triglycerides formed between glycerol and various fatty acids. Most fatty acids are long straight-chain compounds with an even number of carbons and the double bonds. However, some fatty acid chains, like those in ricinoleic and vernolic acids, bear functional groups, hydroxyl and epoxy groups respectively.

Vegetable oil-based polyesters

The carbon-carbon double bonds in vegetable oils can be polymerized by free radical polymerization. Drying oils can undergo auto-oxidation with the help of an oxygen atmosphere to form peroxides which undergo crosslinking through radical recombination to form highly branched or crosslinked polymeric materials.

Vegetable oil based polyesters also called as alkyd resins are the largest group of synthetic resins used in coating industry. These are prepared from vegetable oils by polycondensation of a diacid and a diol or hydroxyl acids. A vegetable oil monoglyceride can be reacted with various anhydrides, diacids to give polyesters. Various fatty acids can also be used for preparation of alkyds. These binders provide excellent set of overall properties and have the potential to replace industrial polyester resins. Alkyds used in surface coatings are generally curable either from residual carboxyl and hydroxyl functionalities or by unsaturation provided by fatty acid/ oil component.[4,5]

Epoxidized oil

The carbon-carbon double bonds in the fatty acid chains of the vegetable oils can undergo various reactions to append different polymerizable functionalities. Vegetable oil can be epoxidized via several method using peracids. The unsaturation present in oil backbone is converted into epoxide linkage. This can be further modified into hydroxyl groups through hydrolysis. The epoxidized oil or oil based polyol can be utilized for various applications such as coatings, plasticizer etc.

Acrylated epoxidized oil, synthesized from the reaction of acrylic acid with epoxidized oil has been extensively studied in polymers and composites. To make polymeric materials more biorenewable, a novel reactive diluent, acrylated epoxidized fatty methyl ester, has also been used as a styrene replacement in polymerizations with the advantage of reducing hazardous air pollutant emissions and health and environmental risks. These monomers can then be blended with a reactive diluent,

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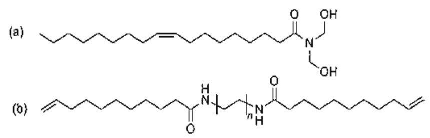
similar to most conventional vinyl-ester resins, and cured by free-radical polymerization. [6]

Vegetable oil-based polyamides

Vegetable oil-based polyamides have been used in the ink and paint industries. Soya-based polyamides have been prepared and processed into dual-component toners, which exhibit printing performance comparable to that of a commercial toner. Soya based copolyamides have also been obtained by condensation polymerization of soy-based dimer acids, diamines and amino acids. Recently, vegetable oil-based fatty amide monomers, such as fatty amide diols (Scheme a) and castor oil amide-based α,w-dienes (Scheme b), have been utilized to prepare polyamides. [7]

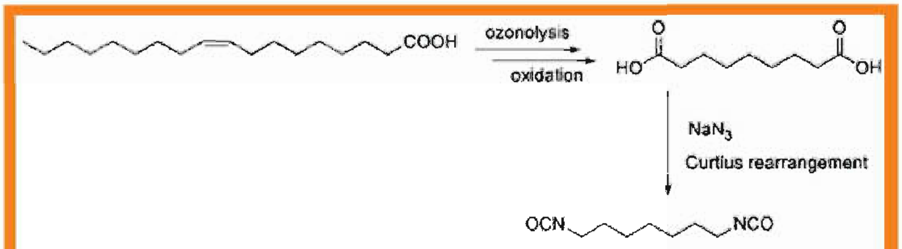


Vegetable oil-based polyurethanes

Vegetable oils as discussed earlier can be converted into polyols, which can react with diisocyanates to give polyurethanes. Castor oil and its derivatives, such as ricinoleic acid, have been used to prepare PUs directly or after modifications. These castor oil-base PUs display good mechanical properties, comparable to those of petrochemical PUs and may find applications as wood adhesives, flexible foams and hard elastomers.

Vegetable oils other than castor oil can be used to prepare polyols by a variety of methods, such as ring opening of epoxidized plant oils. Polyols based on a variety of epoxidized oils have been polymerized with MDI to give PUs. It has been found that the differences in properties of these PU networks result primarily from different crosslink densities and less from the position of the reactive sites in the fatty acids. Vegetable oil-based polyols with a range of hydroxyl numbers have also been prepared by hydroformylation, reduction and partial esterification of the hydroxyl groups with formic acid. These polyols have been reacted with MDI to give PUs with different crosslink densities. Currently, utilization of vegetable oil-based polyols for polyurethane dispersions is also extensively studied.

Recently, diisocyanates derived from fatty acids have been synthesized. Ozonolysis and oxidation of oleic acid affords azelaic acid. This diacid has been converted to the corresponding 1,7-heptamethylene diisocyanate (HPMDI) *via* Curtius rearrangement.



Synthesis of a diisocyanate from oleic acid.

Compared to the petroleum based, commercially available 1,6-hexamethylene diisocyanate (HDI), PUs prepared from HPMDI have similar properties within acceptable limits. HPMDI and HDI have also been used to prepare linear thermoplastic PUs. [3]

Polymers from other biobased Sources

There are other biological derivatives which have been successfully used for polymer synthesis. These include lignin, tannin, sucrose, proteins, polysaccharides etc. The hexahydric alcohols, **mannitol** and **sorbitol**, as polyfunctional bodies are capable of forming resins with polybasic acids or with resinous monobasic acids. Such resins derivable from the hexitols include the alkyd and the ester gum from rosin.

Tannins are natural phenolic structures present in numerous wood species. Tannins are oligomeric compounds characterized by sequences of units bearing two or more OH groups per aromatic moiety as exemplified by the polyflavonoid structures. Tannins, together with appropriate cross-linking agents, provide materials displaying properties comparable to those of conventional phenol- and urea-formaldehyde counterparts which are mainly used for adhesive application.

Rosin is an abundantly available natural product and widely studied for polymer synthesis. Rosin is mainly obtained from the exudation of pines and conifers. It is also obtained by the distillation of crude tall oil. Rosin is a mixture of acidic (90%) and neutral (10%) compounds. The acidic components, generally named rosin (or resin) acids, are also a mixture containing mainly isomeric abietic-type acids (40-60%) and pimaric-type (9-27%) acids on the basis of total rosin weight. [8]

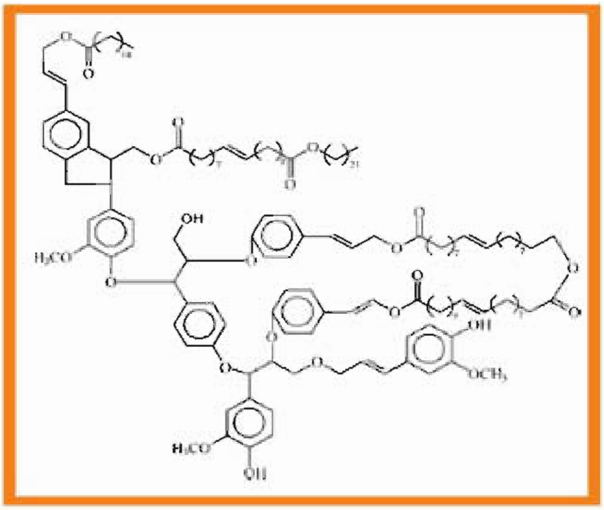
The different derivatives of rosin acid have been successfully used for preparation of polyesterimide and polyamideimide. Rosin-based polyols can be also prepared and applied to polyurethane synthesis. The adduct of levopimaric acid (rosin derivative) and acrylic acid was used to synthesize polyesters and polyamides. Rosin-based polyamides can also be used as hardeners for epoxy resins. Glycidyl esters of maleopimaric acid have also been studied and cured with 1,2-cyclohexanedicarboxylic anhydride. Rosin-based epoxy demonstrates significantly higher Tg, modulus and thermal stability than its plant oil counterparts, and exhibits very similar properties to those of the cured glycidyl ether of bisphenol. Rosin could be an important renewable feedstock for high-performance biobased epoxies. [9]

Cardanol, a phenolic-based by-product of the cashew nut industry, is obtained by distilling cashew nut shell liquid (CNSL). As per the literature, CNSL is used in the manufacture of special phenolic resins for coatings, for lamination, and as friction material. These polymers are synthesized from CNSL or cardanol-either by poly-condensation with electrophilic compounds such as formaldehyde, furfuraldehyde, or chain polymerization through the unsaturation present in the side chain using acid catalysts, or by functionalization of the hydroxyl group and subsequent oligomerization to obtain a functionalized prepolymer. Cardanol can be condensed with active hydrogen-containing compounds such as formaldehyde at the ortho- and parapositions of the phenolic ring under acidic or alkaline conditions to yield a series of polymers of novolac or resole types. The cardanol-based novolac-type phenolic resins may be further modified by epoxidation with epichlorohydrin to duplicate the performance of such phenolic-type novolacs. These epoxy resins are comparable to conventional epoxy resins. [10]

Lignin is an abundant polymer present in woody plants providing the glue that binds fibres such as cellulose together. It is available as a by-product of pulping wood with lignin contents of 5-50% as sulphonated lignins from Kraft pulping. Organosolv lignin is available from an alcoholic pulping process as the only nonsulphonated lignin. The abundance of different types of lignins as a waste product in pulp mills has made such materials an attractive proposition for the preparation of adhesives. The literature on the use of lignins to prepare wood adhesives is very extensive and good reviews of it exist. [11] The reactivity of lignin is determined both by its particular structure with specific functional groups and by its structural modifications. Lignins have phenolic hydroxyl groups at alpha and gamma positions on the side chain. The presence of hydroxyl groups, both phenolic and aliphatic, in lignin has enabled its utilization as a substitute for phenol and its derivatives in synthesis of different products for various applications. [12]

From many years, lignin was mainly underutilized due to its low chemical reactivity, heterogenous structure and diverse chemical compositions. Currently lignin, predominantly as lignosulphates, is used as a binding and dispersing agent in different industries. The chemical reactivity of such compounds can be improved by various modifications. Hydroxymethylation of lignin consists of reaction of lignin with formaldehyde in alkaline medium. Through this type of reaction, hydroxymethyl groups are introduced in the lignin's reactive positions, mainly in ortho positions (in relation to phenolic OH groups) of aromatic rings. The second possibility to obtain lignin-based epoxy resins is an epoxidation reaction, using both the alkali lignin precipitated from black liquor and hydroxymethylated lignin. [13] Lignin can be effectively used as replacement of hazardous bisphenol A for liquid eposy resin synthesis. It can also be an ideal replacement for petroleum-based resin due to the phenolic backbone- especially in electronic components. [14]

Suberin is an almost ubiquitous component of the outer bark cell walls of higher plants, representing typically 20-50% of extractive-free outer bark weight, but is also present in some of their other organs like the roots. The structure of this macromolecule is shown as follows.



The aromatic domains of suberin evoke roughly the structure of lignins, whereas the predominant aliphatic counterparts are unique with their long nonpolar chains terminated by functional groups. For a polymer chemist, these structures are particularly interesting, and their isolation by ester cleavage has provided a detailed map of their specific abundance in terms of chain length and nature, number, and position of their polar groups. The most significant fragments isolated from the suberin of cork oak, which are accompanied by numerous homologues are ω-hydroxyfatty acids, α,ω-dicarboxylic acids, fatty acids such as octadecanoic acids, 9,10-epoxioctadecanoic acid etc.. All of them are in fact potential monomers for the synthesis of polyesters with interesting hydrophobic and biodegradable properties. Recent study of the polycondensation of these macromonomers, as obtained from the hydrolysis and methanolysis of cork suberin, using various catalytic systems, indicated that low-*Tg* semicrystalline polyesters are readily obtained and that, not surprisingly, their films displayed a marked hydrophobic character with water contact angles of ~100°. [15]

Sucrose polyesters consist of a sucrose backbone and natural fatty acid residues linked to sucrose through ester bonds. Since one to eight fatty acid chains can be attached onto sucrose, the physical properties and reactivity of sucrose polyesters may be tailored by the degree of esterification and by choosing the appropriate natural oils to achieve the right fatty acid chain length distribution and unsaturation level. Thus, sucrose polyesters offer a unique chemical platform by controlling their molecular architecture and functional density, enabling a compact crosslinking structure to an auto-oxidizing paint system. Sucrose polyesters can be used in alkyd resins as a nonvolatile low viscosity component that reacts into the polymer film during autooxidative crosslinking processes. The sugar and fatty acid components of sucrose polyesters displace common alkyd ingredients that are derived from petroleum feedstocks, such as pentaerythritol and isophthalic acids, to result in a high organic renewable content coating system. Although sucrose polyester alkyds lend themselves to high-solids solventborne resin systems, they can also be adapted to emulsion resin systems for formulation of very low-VOC waterborne coatings. [16,17]

Conclusion

There is a pressing need for all parties concerned, whether scientific institutions, industrial R&D sectors, or appropriate government departments, to enhance considerably the implementation of activities aiming at accelerating the development of polymers from renewable resources. Although petroleum, natural gas, and carbon are here to stay for some time to come, it is likely that their price will remain very high and that their reserves will start dwindling within a few decades. It would therefore be particularly wise to prepare the future with a responsible strategy aimed at assessing the potential of both known and novel macromolecular materials through a more systematic and intense research program covering all aspects of their conception, characterization, and possible applications.

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Weatherproof coating with water base - Acrylic resin

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Introduction

PAINT has been used for surface coating & artwork for many thousands of years. Over the last two decades, water-based acrylic coatings have come to dominate the paint and waterproof coatings business. Market share gains have been driven by some thirty years of proven exterior performance coupled with various end-user trends and preferences. Environmental concerns surrounding VOC impact on air quality have fueled the substitution of solvent-containing coatings with water-based alternatives. Other health concerns related to worker and building occupant exposure and flammability risks associated with these hazardous chemicals also favor water-based systems. And everyone now sees increased interest in the energy-saving, improved urban air quality, and durability benefits of weatherproof system that are based on acrylic coatings.

The technical article focuses on need for acrylic resin for making weatherproof systems as value components of high performance coatings.

Acrylic resin

In the coatings fields, the term "acrylic" resin applies to the polymers and copolymers of the esters of meth acrylic and acrylic acids. Copolymers of these esters with no acrylic monomers such as styrene, butadiene, or vinyl acetate are also referred to as acrylic resins.

Acrylic resins are very versatile and popular for industrial roof coatings. They provide toughness, good weatherproofing ability, and resistance to abrasion and chemical attack. They are also considered to be better than alkyd resins for gloss retention. Acrylic thermosetting resins that are cross-linked with epoxy or amino resins are used in the roof coating industry because of their excellent physical and chemical properties. Along with the stability of the acrylic resins and their toughness and chemical resistance, they also provide an appealing, high-quality coating. The hardness and slip properties can be varied over a wide range to suit the demands of the application.

Most thermosetting water base acrylic resins available for commercial roof coating applications contain relatively considerable amounts of styrene, epoxies, or amine resins to paint Components enhance their in-use properties, to lower their cost, or to effect cross-linking. The term "acrylic thermoset" is even applied to coatings that have only the acrylic monomer present to establish the curing or cross-linking sites for the coating. Because of the non-acrylic nature of these coatings, they may not exhibit the characteristic properties normally sought in an acrylic coating.

Requirements of acrylic in waterproofing

Up-front, these systems must block bulk water movement into the substrate they protect, so the coating products themselves plus the method of application must ensure a watertight membrane. And because they are applied to a variety of substrates, including asphalt-based roofs, plastic and rubber single ply roofing, sprayed polyurethane foam, metal and concrete, the chosen coating must maintain its waterproofing and protection performance over a specific substrate type. To ensure this long-term performance, a coating system must weather well, resisting the damage wreaked by the sun's UV and hot infrared radiation. Coatings must have built-in properties to handle building movement and temperature changes that cause expansion and contraction stress. Beyond these factors, foot traffic on roofs, regional hail activity, and ice and snow buildup require added strength and flexibility.

Why and how to make good weatherproof

Over the years, the technology surrounding acrylic coatings has matured. Leading raw material manufacturers and top coating formulators understand the principal components of proven coatings and the role each constituent plays in meeting the above performance requirements to ensure long-lasting waterproofing. Below, we highlight many typical coating components and their contribution to durable performance based on years of exterior exposure on actual buildings.

Acrylic Polymer Resins: The review of acrylic coatings starts with the core of a coating recipe, the acrylic polymer is the key determinant of crucial coating properties like water resistance, impact and tear strength, flexibility, adhesion to a given substrate, and overall durability. What determines the quality of an acrylic polymer vis-à-vis these performance parameters is the chemical composition of a polymer coupled with the actual synthesis process by which raw materials (monomers) are reacted to produce the final emulsion polymer. 100% acrylic compositions are preferred versus co-polymers like styrene acrylics and vinyl acrylics. Styrene acrylics often show inferior weathering and color instability due to UV attack of the aromatic chemistry in styrene; vinyl acrylics, polymers often used in cheaper interior paints, show poorer water resistance due to hydrophilic properties of the vinyl chemistry. 100% acrylic polymers, however, are totally transparent to UV rays, so they function as durable binders that can hold a coating film together for the long haul. 100% acrylics have proven superior adhesion properties, being the key components of caulks, architectural sealants, and tape and label adhesives. And properly engineered acrylic polymers provide the right balance between strength and stretch, also known as toughness. For instance, typical paints are not waterproof coatings and always develop small cracks over time due to building movement and temperature fluctuations. Paints are based on "hard" acrylic polymers. Waterproofing coatings, however, must be formulated with so-called "elastomeric" acrylic polymers that impart more low-temperature flexibility while maintaining other crucial strength, adhesion and water resistance properties. The bottom line is that incorporating the appropriate acrylic polymer is an essential determinant in the overall performance of an elastomeric acrylic coating.

Other important selection of ingredients for weatherproof coating are described as follows:

Titanium Dioxide (TiO_2): TiO_2 is termed a prime pigment in acrylic coating formulations due to its impact on coating durability and reflectivity. TiO_2 comes in different grades at different prices. Various grades can oxidize at different rates and cause different degrees of coating chalking over time.

Zinc Oxide (ZnO): ZnO is another so-called prime pigment that provides opaqueness to UV, whiteness and reflectivity to a well-formulated acrylic coating. More importantly, ZnO also resists mildew and algae growth.

Fire Retardants: The last of the prime pigments are inorganic materials that suppress smoke generation and flame spread. Fire retardant coatings are required for achieving certain widely sought fire ratings like UL 790. Aluminum Trihydrate is the most common retarder used in coatings.

Extender Pigments: Whereas prime pigments provide color, UV blocking, and fire resistance, so-called extender pigments mainly impact coating abrasion resistance, overall coating raw material cost, and possibly color retention. Typical extender pigments are Calcium Carbonate ($CaCO_3$), Talc powder, Clay and Silica. These different pigments cannot be readily substituted for one another since they differ in long-term oxidation that impacts color retention.

Dispersants and Surfactant: These "salt and pepper" additives impact the ease and uniformity of how prime and extender pigments are blended into an acrylic coating. They also provide in-can stability so that a coating remains a uniform blend that can be applied consistently and efficiently in the field.

Defoamers: Entrapped air, often exacerbated by necessary inclusion of dispersants and surfactants, creates zones of weakness in coating systems, so use of proper amounts of an appropriate defoamer ensures a better performing membrane.

Preservatives: Acrylic coatings are water-based and susceptible to bacteria and fungal growth both in packaged storage and later as a dry installed coating. To ensure storage stability and film integrity in the field, appropriate "salt and pepper" mildewcides and algaecides should be incorporated into quality coatings.

Thickeners: Three classes of thickeners, namely, cellulosic, attapulgite clay and associative thickeners, are used to achieve a stable coating with the right rheology. Coating viscosity and overall rheology affect application efficiency, sag resistance for vertical wall waterproofing, and overall water resistance. The subtleties of developing coating recipes with appropriate levels of specific thickeners should not be underestimated.

Plasticizers: Plasticizers are additives used in conjunction with cheaper, harder paint polymers to provide the added flexibility properties that elastomeric waterproofing coatings need. The problem is that these external plasticizers migrate out of coatings, causing discoloration, dirt pickup and loss of reflectivity, mildew and algae growth, and overall coating embrittlement. In terms of specifying acrylic coatings for long-term performance, just say "no" to formulations with plasticizers.

Coalescent Solvents & Glycols: Historically, paint manufacturers often required these additives to compensate for harder paint polymers and freezing conditions that paints see in long-term storage and transport to end-users. Such additives, however, increase the VOC content of acrylic coatings, affect in-field dry times, and increase overall cost. The sophisticated waterproof coating manufacturers take advantage of state-of-the-art soft acrylic polymers and incorporate glycols only when absolutely necessary.

Critical compromises to avoid

In this age of increasing business competition, especially in mature industries like acrylic coatings, here are some all-too-common formulation approaches that risk long-term performance:

- Coating formulators switch from the most proven and durable 100% acrylic polymer raw materials to less expensive styrene acrylic and vinyl acrylic chemistries.
- Coating formulators switch to new, lower-cost 100% acrylic polymer offerings that have not been thoroughly tested in years of actual exterior waterproofing applications.
- Coating formulators start blending together various lower-cost polymers creating "new and improved" products that lack track history in actual field applications.
- Coating formulators modify product recipes to reduce cost but trade-off on quality and performance by:
  - ✓ Using inferior grades of TiO_2
  - ✓ reducing the level of Polymer compared to all pigments (see PVC below)
  - ✓ reducing the levels of Polymer and Prime Pigments (TiO_2) in favor of cheap Extender Pigments ($CaCO_3$)
  - ✓ decreasing the levels or eliminating altogether preservatives such as ZnO and Biocides
  - ✓ reducing the Volume Solids of the final coating product

Manufacturers and end-users should understand a key coatings concept called PVC (pigment volume content). PVC refers to the ratio between all pigments and the combined amount of pigments plus polymer. Higher PVC means there is less polymer relative to prime and extender pigments. Lower PVC means the coating formulation is rich in the most important raw material, acrylic polymer. A minimum standard for a softer elastomeric polymer coating would be 43% PVC, however, other systems require PVCs in the 30%-40% range for optimum toughness and adhesion properties.

The Risk is that for a very small % reduction in total installed cost; actual life-cycle costs can substantially increase because a less proven and inferior acrylic coating system might:

- Lack important strength, elongation and adhesion properties
- Succumb to UV attack and premature weathering
- Be less reflective and energy efficient

- Lack water and microbial resistance
- Pick-up dirt more readily, affecting aesthetics and reflectivity
- Cure less uniformly and mud crack

Inferior acrylic coating systems suffering from these deficiencies will mean less weatherproofing performance, shorter coating and roof system performance life, and overall higher operating, capital and life-cycle costs.

Finishing comments

Weatherproofing commercial and industrial buildings with high performance acrylic coating systems is proven and cost-effective considering long term performance achieved by end application. Further to ensure consistent application, coatings must be uniform in appearance, rheology and texture with no agglomeration of pigments and other defects.

Acknowledgement

The author acknowledges the support of management of NIPPON PAINT (INDIA) Pvt. Ltd. and thanks and gratitude are also due to Mr. Hardev Singh (President -Nippon Paint India) for their guidance & encouragement.

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Stress: A silent killer

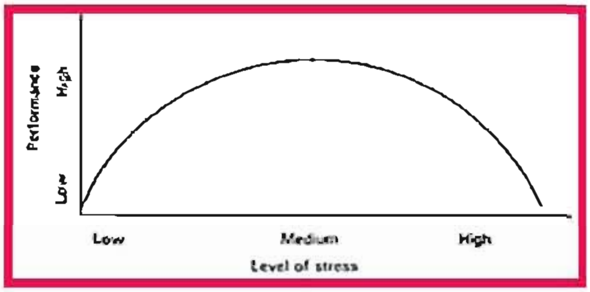
Dr. Sushil K. Sabnis* & Salil S. Sabnis**

In this era of modern technology and speed, global competition and consumerism, stress is a major concern for the Indian working community. It is affecting the physical and psychological health of the employees resulting in reduced productivity and functioning of the organisation. In modern life the definition of stress should be tense situation of the brain and more so of the mind. It is medically proved that calm brain and calm mind is a key to healthy body; as stress will generate or will be a cause to many a diseases. This has precipitated because of ambitions of the human mind. Ambition can be defined as "the urge to achieve goals." Thus the aim of the mind to achieve goals gives rise to efforts on all fronts and thus cause stress to the body.

Dr. Matthew Burg, a management researcher defines stress as "the state in which individuals are faced with the need to make difficult or undesirable changes in order to adapt to events and situations in their lives. This not only includes the body's response to physical and psychological demands but also to mental, emotional, and behavioral patterns."

The basic reasons for giving birth to stress are work overload, job insecurity, economic conditions, family disturbances, boredom, loss of appetite and increasing pace of life. This further results in turbulent health conditions like muscle spasms, hypertension, coronary disorders, ulcers, body aches, etc. Stress has thus become an epidemic in almost every occupation in India.

High level of stress results in a decline in the performance of employees. This is evident from the stress performance curve shown in the figure below:



Albert Ellis, a famous psychologist has put forth REBT - 'Rational Emotive Behavior Therapy' which says that unhappiness or pain of life is due to abnormal expectations of each person. According to him expectations of human beings are of three types: (1) whatever I do should be the best and correct. Everyone should always appreciate me. If I can't do this that means I am unfit in this world to survive. (2) Everyone around should behave in a way which pleases me. If they don't then they should be punished. (3) I should always get whatever I wish for. I get upset if I don't get it. The first point of this theory keeps you always alert and tense to do the best. You feel upset and defeated if you go wrong and become unhappy. The second point will make you angry if the other people do not behave with you the way you want them to behave. And if that happens you become angry and thus stressed. The final point of this theory would mean you should always have success or have a happy ending to your task completion. If this does not happen you will get nervous and crack down.

In 'Geeta' the 'bhagwan' has said that one should get full control of his entire mind. 'Mahavir' has said one should have full control of his senses. This means one should not get perturbed by any deviating forces of life and don't allow body to get stressed. This does not mean that one should not have ambitions. But this means keep your ambitious mind under full control. Your expectations should be moulded according to situations. Or else you will be stressed. Look at a dog sleeping on the floor; its tail is always spread away from its body whereas a cat lying on the floor, the tail is always wrapped around its body. Thus the dog's tail can be stepped over by the people passing by but not in case of a cat as it is not spread. Thus your ambitious mind needs to be controlled all the time. Kill your ambition before it kills you.

Stress does not occur overnight. Rather it is a slow process. The symptoms occur gradually and start increasing in frequency and intensity over a period of time. This can be understood by Hart's (1990) three stage stress model. The first stage is the 'immediate stress response' such as an increase in blood pressure to achieve a deadline at work. This further leads to 'early warning signals' causing internal damage of the body such as headaches, backaches, muscle stiffness, infections, colds, indigestion, gritting of teeth, knotted stomach, etc. The final stage being the long term effects caused due to rise in the intensity levels of stress.

According to Kalia (2002), an estimate of The World Health Organisation (WHO) Global Burden of Disease Survey showed that stress related disorders would be the second leading cause of disabilities by the year 2020. An international study revealed people born after 1955 are up to three times as likely to experience stress related disorders. Routine cardiac screening tests at the Escorts Heart Institute in Delhi justify that most working executives are in the advanced stages of stress (Shane, 2007). A study by the Indian Council for Research on International Economic Relations reported that India's rapid economic expansion has put employee incomes and corporate profits on the rise but simultaneously has led to workplace stress and lifestyle diseases. A

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survey by Regus has confirmed that 45% of the Indian workers are stressed due to their constant focus on achieving profits for the organisation especially during the economic downturn. Stress has thus spread across the entire nation like a wild fire.

Combating stress is thus a major concern for our society. This can be achieved by maintaining a balanced diet, regular exercise, getting proper sleep and a principled daily routine. Attending stress management programmes, performing yoga and playing sports is a healthy way of handling stress. Spending time with family, taking a short vacation from work, listening to music, hiking, having pets at home are some popular stress relieving options.

Stress is not always a negative condition. Sometimes the outcome of stress is positive amongst individuals, giving them an "edge" to do their best in tough challenging situations. It is therefore very critical for every organisation to handle stress positively in order to increase productivity.

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INDIAN RESINS MANUFACTURER'S

17th IRMA AGM

The 17th Annual General Meeting of the Indian Resins Manufacturers' Association was held on the 16th September 2011 at Presidency Golf Club, Mumbai.

D M Sathaye

Reporting on the activities of the year gone by Mr Ballal Chandrachud, President proudly announced that the IRMA southern Region which was inaugurated at Hyderabad with 25 members had now 32 members. He also announced that the membership of the Association had seen a growth and had touched 136 of date.

He also spoke about the move for supporting the anti dumping duty on phthalic anhydride along with other associations. Similarly he spoke about the sorting of the pollution problems faced currently by the members. Speaking about the project Vision for Next generation he informed that a committee has been formed to formulate a short term plan (4 yrs) and a long term plan (20 yrs). He also then listed the activities conducted by the Association.

Ballal Chandrachud

Dr Nadkarni

Later the new committee was duly elected for the next term. Mr Ashok Goklani was elected the president. (NEW COMMITTEE BOX)

On this occasion a lecture on the topic '

Dr P.S. Samant

Mr. Ashok Goklani

IRMA AGM in progress.

Calm Sutra' (the art of relaxation) was given by Dr Dilip Nadkarni. Mr D M Sathaye introduced the guest speaker.

"Is stress the better half of your life? Bust it with Calm Sutra", said Dr Nadkarni. He

Mr. Goklani felicitating Mr. Chandrachud

Mr. Nilesh Kumar Jain, Chairman, Southern Region

The IRMA Team

recommended the following Stress Busters.

Physical activities like stretching, Yoga, aerobics, weight training, swimming, progressive muscle relaxation, breathing exercises, posture training etc Dietary drills like meditative eating, balanced eating, good hydration etc.; Life enriching measures like vacationing, meaningful friendship, humor, massage etc

"The list may go on with many techniques innovated or modified by persons to suit them. You have to choose the method which suits your personality, your body, your mindset, your cultural background or just what you fancy. As long as you have the resource and the inclination you can choose one, two or all of the above to make life more relaxed and stress free. You can go a step ahead and invent your own method of relaxation", he said.

In the end Mr Ashok Goklani gave the vote of thanks. ■

View of the audience

RAW MATERIAL SCENARIO

NAME OF THE CHEMICAL	PRICE /KG.	REMARK
Adipic acid	Rs. 125.00 Basic	International booking $ 2250
Benzoic acid	Rs. 96.00 Basic	Imported material available
Bisphenol "A"	Rs. 98.00 Basic	Local material not available. International Booking $ 2050.
Normal Butanol	Rs. 88.00 Basic	International booking $ 1650.
Cyclohexanone	Rs. 103.00 Basic	Poor availability. International booking $2040
Diacetone Alcohol	Rs. 96.00 Basic	Likely to remain steady.
Diethylenetriamine (DETA)	Rs.170.00 Basic	International booking $3600.
Epichlorohydrin	Rs.110.00 Basic	International price $ 2325.
Ethylenediamine	Rs.170.00 Basic	International Booking $ 3200.
Fumaric Acid	Rs. 74.00 Basic	International Booking $1470.
Glycerine	Rs. 47.00 Basic	Price expected to go up. International price $ 850
Gum Rosin	Rs. 120.00 Basic	Poor availability. International booking $ 2260

Isopropyl Alcohol	Rs. 79.00 Basic in barrels	International booking $1600.
Maleic Anhydride	Rs. 83.00 Basic	Imported material available. International booking $1630.
Melamine	Rs.76.00 Basic	Imported material available
M.M.Monomer	Rs. 130.00 Basic	Price expected to go up.
Paraformaldehyde 91%	Rs. 42.00 Basic	International booking $835.
Pentaerythritol	Rs.92.00 Basic	Imported material available.
Phthalic Anhydride	Rs. 74.00 Basic	Expected to go up.
Phenol	Rs. 102.00 Basic Rs. 92 in tanker	Easy availability. Price expected to remain steady or may go up.
Toluene	Rs. 64.50 Basic	Imported material available.
TETA	Rs. 230.00 Basic	International price $4600.
Mix-Xylene	Rs. 64.50 Basic Rs. 77.00 Imported	Easy availability.
Ortho- Xylene	Rs. 75.00 Basic	Imported material available.
Indicative prices as on 12th September 2011		

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Mr. Ashok Goklani
President

Mr. B. G. Sakaria
Vice-President

Dr. P. S. Samant
Hon.Secretary

Mr. Siddharth Shah
Treasurer

Mr. Nirav Raveshia
Member

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Member

Mr. T. R. Raghuraman
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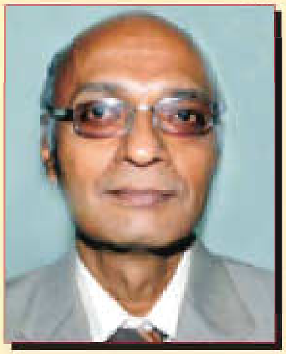
Mr. Subhash L. Purohit
Member



Mr. Ashok Shah
Member

Managing Committee Members of IRMA Southern Region

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Mr. Piyush Maheswari
Vice Chairman

Mr. Satish Kumar
Secretary

Mr.V. Chandrasekhar
Joint Secretary

Mr. Suresh Agrawal
Treasurer

Mr. Kewal Chand Jain
Chairman (Membership Drive)

Mr. C. Ramachandran
Chairman (Technical/Programme Committee)

Mr. Rajesh Kumar Agrawal
Chairman (Fund Raising)

Mr. Rajiv Pandey
Member

Entertainment Page

Some scientists decided to do the following experiments on a dog.

For the first experiment, they cut one of the dog's legs off, then they told the dog to walk. The dog got up and walked, so they they learned that a dog could walk with just three legs.

For the second experiment, they cut off a second leg from the dog, then they told the dog once more to walk. The dog was still able to walk with only two legs.

For the third experiment, they cut off yet another leg from the dog and once more they told the dog to walk. However, the dog wasn't able to walk with only one leg.

As a result of these three experiments, the scientists wrote in their final report that the dog had lost its hearing after having three legs cut off.

What is the longest word in the English language?
SMILES: there is a mile between the first and last letters!"

Teacher: Maria please point to America on the map.
Maria: This is it.
Teacher: Well done. Now class, who found America?
Class: Maria did.

What are the three quickest ways of spreading a rumour (or gossip).
·Telegram ·Telephone ·Tell a woman

A man is talking to God.
The man: "God, how long is a million years?"
God: "To me, it's about a minute."
The man: "God, how much is a million dollars?"
God: "To me it's a penny."
The man: "God, may I have a penny?"
God: "Wait a minute."

Teacher: Tell me a sentence that starts with an "I".
Student: I is the...
Teacher: Stop! Never put 'is' after an "I". Always put 'am' after an "I".
Student: OK. I am the ninth letter of the alphabet

Teacher: How can we get some clean water?
Student: Bring the water from the river and wash it.

Q: What starts with E, ends with E and only has one letter?
A: An envelope.

Q: If you drop a white hat into the Red Sea, what does it become?
A: Wet.

Q: What do you call a boomerang that won't come back?
A: A stick.

Q: Where do you find giant snails?
A: On the ends of their fingers. (Giants' nails.)

Q: What travels around the world and stays in a corner?
A: A stamp.

Q: What is white when it's dirty and black when it's clean?
A: A blackboard.

These need to be written.
Q: What do you call a pig with three eyes?
A: A piiig.

Q: What goes Oh, Oh, Oh?
A: Santa Claus walking backwards.

Q: What do elephants have that no other animal has?
A: Baby elephants.

Depending on where you live, students will enjoy this one.
Q: What do you call a hippie's wife?
A: Mississippi.

Q: What did the ocean say to the beach?
A: Nothing, it just waved!

The First 3 Years of Marriage

- In the first year of marriage, the man speaks and the woman listens.
- In the second year, the woman speaks and the man listens.
- In the third year, they both speak and the neighbors listen.

A man inserted an 'ad' in the classifieds: "Wife wanted".

The next day he received a hundred letters. They all said the same thing: "You can have mine."

Love is one long sweet dream, and marriage is the alarm clock.

Q: What happens when "you" and "I" are gone?
A: Only 24 letters are left. (you=the letter "u" and I the letter "i".)

Riddles of Alphabet

Q: What letter of the alphabet is an insect?
A: B. (bee)

Q: What letter is a part of the head?
A: I. (eye)

Q: What letter is a drink?
A: T. (tea)

Q: What letter is a body of water?
A: C. (sea)

Q: What letter is a pronoun like "you"?
A: The letter " I "

Q: What letter is a vegetable?
A: P. (pea)

Q: What letter is an exclamation?
A: O. (oh!)

Q: What letter is a European bird?
A: J. (Jay)

Q: What letter is looking for causes ?
A: Y. (why)

Q: What four letters frighten a thief?
A: O.I.C.U. (Oh I see you!)

Q: What comes once in a minute, twice in a moment but not once in a thousand years?
A: The letter "m".

Q: Why is the letter "T" like an island ?
A: Because it is in the middle of waTer.

Q: In what way can the letter "A" help a deaf lady?
A: It can make "her" "hear.

Q: Which is the loudest vowel?
A: The letter "I". It is always in the midst of noise

Q: What way are the letter "A" and "noon" alike?
A: Both of them are in the middle of the "day".

Q: Why is "U" the happiest letter?
A: Because it is in the middle of "fun".

Q: What word of only three syllables contains 26 letters?
A: Alphabet = (26 letters)

Q: What relatives are dependent on "you"?
A: Aunt, uncle, cousin. They all need "U".

Q: What is the end of everything?
A: The letter "g".

A: Why are you crying?
B: The elephant is dead.
A: Was he your pet?
B: No, but I'm the one who must dig his grave.

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