INDIAN VINYL COUNCIL

News Letter

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Vinyl is an integral part of our day to day life

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From the desk of Editor

The Indian Vinyl Council is a fairly new initiative to specifically look into the interest of the business community and consumers involved in the value chain of 'vinyl'. Good traction is already taking place in attracting not only new members but also renewed interest amongst its members to discuss and debate on issues which could help in enhancing the cause of the industry. No doubt that such effort takes time to generate explicit results, but at least fresh beginning is taking place in bringing new methods and initiatives in tackling the problems impinging upon the industry's growth. With the pandemics slowing down significantly in India, physical meetings among its members have also commenced, enhancing the effectiveness of the relatively new business council.

Discussions on PVC and plastics, naturally leads to discussion of the generation of waste. World over, about 2 billion tons of municipal waste is getting generated, in accordance with the 2018 World Bank report. If nothing is done, this figure could go up to 3.5 billion by 2050. Some of the waste would include plastic materials. Something obviously needs to be done. The steps for eliminating thinner varieties of plastic bags, take-back schemes, charging for plastic bags at shopping counters, are all going to help in reducing the habit of using products which may end up in the garbage bins.

The annual worldwide production of plastics have grown from 2 million tons in 1950 to around 350 million by 2019. So, apart from the waste generation, the fact of enhanced use of plastics necessarily mean that we need to focus on limiting its impact on our environment and be more responsible in its use. To cite an example, developments in the downstream process such as O-PVC not only helps in reducing consumption of PVC resin (upto almost 30 percent) but also improves the performance of the pipes to be competing with conventional metal pipes. Further, the structured wall pipes meet all the requirements of the non-pressure pipes, using either less PVC or incorporating recycled PVC thereby saving the usage of virgin polymer.

Our council is cognizant of the need to continue to focus on responsible vinyl usage and its development. It proposes to take up tasks which would not only help to reduce wastage, but also to reuse wastes such that the environment is protected.

There is a myth that PVC cannot be recycled. This is obviously incorrect. Not only PVC is widely recycled by various manufacturers but the myth has also been proven wrong through some wonderful work being done by VinylPlus wherein they take up targets for recycling of PVC products.

Our humble submission to all the readers of this newsletter is to continue your active participation to add value to the vinyl value chain. And if you are not yet a member of our council, please do join it so that we can all join hands to make a difference to this world. Let us make this invaluable earth more sustainable and worth living for our very own future generations.

Robin Banerjee
Managing Director
Caprihans India Ltd.

You can write to us @ info@indianvinylcouncil.com

All about the Indian Vinyl Council

The Indian Vinyl Council is set up and exclusively dedicated to the cause of entire PVC value chain. The objective of the forum is to serve all the stakeholders of Vinyl Family, i.e the resin producers, additives and related chemical producers, converters, processing and ancillary equipment manufacturers, recyclers of Vinyl products and the end users. With the active and harmonious participation; the members, end users and the public at large will all stand to reap considerable benefits.

The Council will play a pivotal role as the hub of advocacy between the government (state and central), policy makers, regulatory bodies and industry stakeholders to pave the way for the industry by eliminating obstacles and opening the doors to expand the market for the Vinyl industry.

Adding greater momentum to the growth of the Vinyl industry through networking will also be one of the core responsibilities of the Council. It will work towards increasing access to the industry's leaders and enabling them to connect seamlessly with suppliers, academia, regulators, scientists and experts through seminars, conferences, technical meetings and other events.

One of our top priorities is to ensure the efficient diffusion of knowledge to all our members, on the state of art technology, market perspectives, statistics & information and details of global initiatives on sustainability… all relevant to the Vinyl and allied industries.

Our focused approach is to work towards the welfare of mankind and encourage responsible care in an environmentally sustainable manner as practiced and specified in circular economy principles and models.

We strongly believe in supporting & encouraging innovation, and training & skill development within the Vinyl value chain, to facilitate raising the competency and the level of industry to global standards.

We are also committed to developing technical standards for maintaining quality and consistency to enhance the acceptance of Poly Vinyl Chloride and related products and multiply its application in all spheres of life.

IVC Objectives

- To promote and advocate all round development of the entire Vinyl industry comprising of all elements of the Vinyl value chain
- To build a positive image of Vinyl products in eyes of the end-users as well as society at large.
- To assist and collaborate with the government and non-government bodies and statutory authorities for formulating industry related policies including codes and standards and seek representations from such bodies.
- To promote and support standardisation and quality assurance programmes to encourage regulatory compliances.
- To create awareness and educate the end users of the value proposition of PVC products including energy conservation, eco-friendliness and sustainability.
- To support and encourage innovation, training and skill development within the Vinyl value chain and thereby raise the level of industry to global standards.
- To institute and/or fund scientific and economic research in the industry connected with PVC and its products.
- To provide a forum for member associations to collaborate for broadening the market for PVC products.

PVC in building and construction:

Can the "European approach" be considered a good example for India &other countries?

Sanjay Nawander
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PVC is a remarkable and versatile resin, used in a large range of articles, rigid, semi rigid and flexible. Particularly, **PVC is mostly used for a lot of building and construction products, such as pipes, profiles, flooring, cables etc.**

One of the keys of the success of PVC in building and construction have been its outstanding fire performance. In fact, PVC, in comparission with other plastics, has a low flammability. Moreover a pretty low heat release rate (HRR). Particularly the heat released by the article is really the key factor for assessing whether a small and controllable fire can turn into a large and deadly one and, therefore, if people can escape unharmed before the fire becomes too big .Thus, flame retardants and polymers with an intrinsic flame retardancy as PVC, CPVC, PEF, PTFE etc. play a fundamental role in the fire safety.

In fact, PVC, CPVC and fluorinated polymers are used where other polymers fail.

Despite these extraordinary properties, in the European Union (EU) some PVC articles suffered the competition of other "plastics". In particular PVC compounds for cables lost 24% of market share, from 65% in 2000 down to 39% in 2019, with an estimated 35% in 2023 . This happened mainly because PVC has been under attack for some of its"evil issues": PVC emits black dense smoke, its combustion products are toxic, and its fumes are acidic.

The smoke kills more than the fire itself. Actually, almost 75% of the fatalities in fire are due to inhalation of toxic smoke. The "big toxic killer in smoke" is carbon oxide (CO) and, after flash over (i.e., when the fire becomes too big to be extinguished), every polymer releases around 20% of its weight as CO. Therefore, PVC burning does not release more toxic fumes than other polymers. Further more, the fatalities due to inhalation are a direct consequence of the fact that fire has reached the flash over. Therefore, deaths due to smoke inhalation are an indirect consequence of an elsewhere failure.

The smoke obscuration impedes people to escape safe from the fire scenario and to be found by the rescuers. Therefore, the measure of smoke production by articles is another key factor in fire safety.

But does PVC release more smoke than other polymers? Not really. PVC burns less and it has in its magical chemistry all the weapons to reduce smoke, reaching easily the best classes in terms of smoke emission .

Regarding the smoke acidity, by most"fire scientists" it is considered an ancillary measure in fire safety. However, studies show clearly that tenability is driven mostly by narcoleptic substances like CO or HCN than by Hcl .

This means that CO or HCN reach the concentration impeding you to exit safe from a fire scenario, before HCl or other irritant gasses reach the gas phase. That is because PVC articles burn later and in a real fire scenarios HCl decays quickly.

Despite all these considerations, in the European Union (EU), according to Regulation (EU) N°305/2011 (Construction Product Regulation, CPR), cables for fixed installation in buildings must be classified in terms of acidity of the gases released during their combustion. Cables are the only building and construction products having the additional classification for acidity. It is not required for flooring, for linear insulation for pipes, or for panels of PVC-U permanently installed in buildings. PVC cables are in the worst class for acidity, a3, because no PVC compound has been found capable to reach the best classes a1 or a2 yet. Therefore, PVC cables are simply excluded and HFFR cables are replacing them. Further more, in 2017 there were some attempts to introduce the smoke toxicity additional classification for all building and construction products .Smoke acidity and smoke toxicity classifications are just two examples of what can happen to PVC articles, if there is a-priori exclusion of PVC. The strategy of our competitors' plastics has been precise and smart: R&D, innovation, new products, the use of the innovation "up" inside technical committees, and the dissemination of the innovation "down" to the public opinion. This strategy has been a winning strategy and it reflects for example the success of the new halogen-free cables in the EU market in the period 2000 – 2019. Today in Europe the R&D in PVC is mainly focused on bio-based additives. And this is an extraordinary opportunity to make our PVC articles more sustainable and more "competitive" than other competitors' polymers. But the research on PVC fire behavior and novel additives for getting down smoke and smoke acidity is scarce, and this research and its dissemination "up" and "down" can avoid the decline of PVC in some specific fields.

So, coming back to the question in the title of the article: Can the "**European approach**" in B&C (building and construction) be always considered a good example for other countries? The answer is obviously not and what is described above in the EU can be lessons for some other countries to prevent the same wrong evolution of regulations and laws, being aware that the introduction of acidity or toxicity classifications in B&C products can impede the growth of PVC in the market.

Reagens Group is carrying out strong R&D on additives for getting down smoke and smoke acidity. This would help in the effort to promote a good image of PVC. The right combination of CaZn stabilizers and associated flame retardants (including Sb_2O_3-free systems) are produced and are available at Reagens India.

In India Reagens Group has opened a new plant capable to produce 60,000 MT per annum of PVC stabilizers and their strategic intermediates, for all rigid and flexible applications. The stabilizers are in powder (B) and granules (G) and most of them are designed for manufacturing articles for building and construction (B&C). Reagens India (formerly, Indo-Reagens) produces stabilizers like CV/30000 series for a wide range of wires and cables. The AV/20000 product series are largely used for the production of window profiles and LE/60000 series for manufacturing foamed sheets. TU/10000 series is used for pipes and IN/40000 series for fittings, and the product range contains also specific stabilizers for C-PVC

Petrochemicals Industry in Energy Transition and Sustainability

Ms. Aruna Kumari,
Chair
Asia Pacific Vinyl Network (APVN)

The global shift towards a more sustainable future is disrupting the status quo – reshaping power and transport networks and changing consumption habits across the globe. The energy and material transitions are set to be among the biggest influencers on petrochemicals industry over the next 20 years. A transformative road is most obvious.

The energy transition, a drift from fossil fuels and moving towards renewable and clean sources of energy, is well underway. The material transition is an emerging trend, which will transform the way the current production happens.

Both stem from urgent environmental challenges, supported by the societal pressure of consumer outcry and political response of taxation and regulation. In each case, the industry is responding with technological innovation and the upheaval is leading to a total reorganisation of the value chain.

Seen through the lens of sustainability, it is easy to combine these two transitions, but each is moving at a different pace, and will have separate (and sometimes conflicting) impactfor petrochemicals industry.

The next 20 years could see the petrochemicals industry rise to greater prominence as decarbonisation reshapes the oil market.

In the transport sector alone, it is expected that the energy transition would displace 7.5 million bpd of oil.

The increasing share of electric vehicles, together with tightening fuel-efficiency standards for internal combustion engines will erode fuel demand from light vehicles. Growth will slow in road freight and aviation consumption, while industrial and power-generation sectors will continue to shift away from oil to cleaner energy sources.

Eventually, the demand for petrochemicals feedstock to grow four times faster than global oil demand from now until2030 and effectively become the dominant driver of oil demand post 2030.

Refining companies are already reacting to petrochemicals' rising importance.

Even before the pandemic, refining companies were facing challenges of capacity surplus. Covid-19 has wiped out around two to three years of global oil demand growth, exacerbating the situation. By 2023, global supply is expected to outpace demand by almost 3.5 million bpd, which is equivalent to the capacity of around 20 average-sized refineries.

Petrochemicals has become a key differentiator in the outlook for refining assets. Refining companies have started repositioning themselves to increase the proportion of their chemicals output, investing in 'crude-oil-to-chemicals (COTC) facilities. Many of the current facilities in operation still have a strong focus on fuel, however in future fuel will be relegated to a by-product, as production of petrochemicals will be the much better bet in terms of profitability and carbon capture.

Nevertheless, at the same time, as the energy transition appears to be enhancing the prospects for petrochemicals, the materials transition can shift the paradigm in the other direction. Building more circular economy is gaining momentum, which will put pressure on conventional polymer producers.

While perhaps not as severe a threat as climate change, mismanaged plastic waste has become a highly visible issue in recent years. Public awareness is heightened, thanks partially to the tremendously popular Blue Planet documentary series (a British nature documentary series created by BBC) and China's 'National Sword' policy (to monitor and more stringently review recyclable waste imports), which put more stringent restrictions on the import of waste material, forcing the problem back onto the waste generating countries. It is a growing and increasingly global concern.

Regulation is also playing its part. Policies such as single-use and disposable plastics ban are pressuring brands to redesign their packaging applications, pay attention to their waste stream and increase their use of recycled material.

Industry is turning to technology to reduce plastic waste.

Chemical recycling is attracting the most significant interest. An array of technologies can break down hard-to-recycle polymers into new forms of plastic or high-quality feedstock, using depolymerisation; pyrolysis; or super-heating to produce syngas.

Adopting circular economy is proving beneficial by a recent announcement in Spain. Spain's legislation on the circular economy proposes that material produced by chemical recycling will not be subject to its €450/tonne tax on single-use plastic packaging, which is otherwise, imposed on conventional plastics. Industry will increasingly witness these kinds of stimulations across the world in years to come to uplift embracing sustainability.

Another emerging avenue is production of petrochemicals building block using bio-based products, e.g. Ethylene from Ethanol and Phenol from Lignin etc. These are making inroad across the world gradually.

Plastic-to-plastic (P2P) and plastic-to-feedstock (P2F) recycling opens the door to address the plastics waste issue.

The other approach the industry is exploring is bioplastics. Still considered a niche application, representing only around 1% of plastics production, biodegradable polymers such as Poly Lactic Acid (PLA) come from biomass (sugar & corn), rather than fossil fuels, offering the potential of a lower carbon footprint. While conventional polymers e.g. PE & PP emit ~2 kg CO2 per kg of polymer production, PLA emits only 0.5 kg CO2 for per kg PLA production (75% reduction of CO2 emission)

As the material transition, starts to set in over the next 20 years, petrochemicals producers need to seriously adopt their business strategy accordingly.

This will be much like the situation for refineries adapting to changes in oil demand. The solution probably lies in higher integration across the value chain, between chemical recycling facilities and the petrochemical and refining complexes. Production of complementary biodegradable polymers could be another aspect, which petrochemicals producer may look at.

The next two decades are set to be an age of transition for the energy and materials world, and these themes will become increasingly prevalent in business, society and politics. For the petrochemicals industry, the winning formula will come in finding the balance between financial and environmental sustainability.

Lubricants

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PVC – The Versatile Polymer

PVC – one of the most versatile and widely used polymers find applications in all walks of life including agriculture, building & construction, electricals, medical & healthcare, sports & leisure, telecommunications. PVC pipes bring us the potable water and also take away the effluents, PVC doors and windows protect us whereas the wires and cables bring in the electricity. The files and folders protect the documents whereas the blood bags, urine bags, catheter tubes, help treating the ailing patients. And while helping in all these areas, you may be surprised to know that PVC actually helps in protecting the natural resources and saves energy for the future generation.

PVC Compounding and Additives

The most beautiful part of PVC is that just the two major grades, viz. K-57 and K-67 perform most of these wonders and this is made possible because of the capability of the PVC resin to combine with various additives thereby the same grade resin can give you both flexible and rigid products, transparent or opaque product, smooth glossy or rough mat finished product!

A stabilizer- and a plasticizer in case of flexible formulation - would naturally be the important constituent next to the PVC resin in any PVC formulation. Based on the requirements of processing and/or end use characteristics, various other ingredients could be incorporated in the PVC formulation. These include lubricants, U.V. stabilizers, processing aids, impact modifiers, pigments, antistatic agents, flame retardants, smoke suppressants, blowing agents, biocides etc. etc.

Lubricants

Till few years back, when the single component lead stabilizers were very commonly being used in majority of the PVC formulations, separate lubricants would also form an important part of the compounding recipe. With the evolution of 'one pack stabilizer' systems, lubricants form a part of such a system. Still, some formulations require topping up with lubricants to make magical changes in processing/output/product quality.

Typically, a lubricant would be considered as a processing additive, as its primary role is to influence some aspects of behavior of the formulation under the heat and shear experienced during the processing. However, a lubricant can also counter certain factors promoting the thermal degradation, particularly in the case of a rigid PVC formulation, it can increase the output for the given processing conditions or reduce the energy requirement for a given output rate. It can also influence the post processing actions and performance characteristics such as printability, impact strength, pressure test in pipes etc.

The function of a lubricant can be understood more clearly if the chemical properties of the polymers are taken into account. Polymers can be differentiated into two major categories viz. non-polar polymers such as PE, PP and polar polymers such as PVC. The polar polymers contain hetero-atoms other than carbon and hydrogen. Any polar additive incorporated into a PVC formulation will be compatible with PVC and non-polar additives will be incompatible.

External and Internal lubricants

The lubricating action and effects of an additive can be broadly divided into 'external' and 'internal' categories, based on the polarity of the additive used. However, a corresponding division of the lubricants themselves is not strictly applicable as a firm classification, since some combine both functions in varying degrees. More so, such a classification would be applicable to the specific combination of the polymer being processed and the additive being used. For example, paraffin wax behaves as an external lubricant in PVC but as an internal lubricant for polyethylene.

In general, an external lubricant – a non-polar additive - is incompatible with PVC and thus comes onto the surface of the PVC matrix during its processing thereby facilitating its movement with respect hot solid surfaces of the processing equipment. Thus the external lubricant reduces the friction and adhesion between the hot PVC matrix and the working surfaces of the processing machinery by its presence at the interface. This makes movement of the composition through the machinery easier and prevents sticking of the PVC matrix to the hot metal surfaces, which otherwise would result in quick formation of a stationary layer and overheating and burning.

An internal lubricant in a PVC formulation is compatible with PVC due to its good solubility in the polymer and facilitates movement of one polymer chain with respect to others. Thus, the basic effect here is the lowering of inter-particle and inter-molecular friction in the composition throughout the processing which reduces the melt viscosity and frictional heat built-up under shear.

Impact of Lubricants

At the processing temperature, PVC particles break down into smaller particles and this process of conversion is known as 'gelation' or 'fusion'. Suitable lubricants are able to delay or accelerate this process.

Flow behavior: As 'external lubricants' reduces the adhesion, so flow of melt is equal across the die, and it is termed as 'block flow'. In case of 'internal lubricants' the melt flow is low and compared to the centre of the die and flow increases upon increasing the level of 'internal lubricant'.

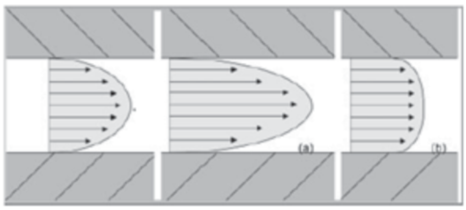

Figure 1: Flow behavior of polymer in presence of, a) internal lubricant, b) external lubricant

Viscosity reduction: short chain and polar lubrication can penetrate the PVC to a certain extent and reduce the friction between the polymer layers and allow the layers to slip over one another, which results in viscosity reduction.

Release effect: Due to non-polarity, external lubricant cannot penetrate the PVC and thus, form a layer/ lubrication film between metal surface and polymer matrix. This lubrication film, allows the heat dissipation and release the polymer.

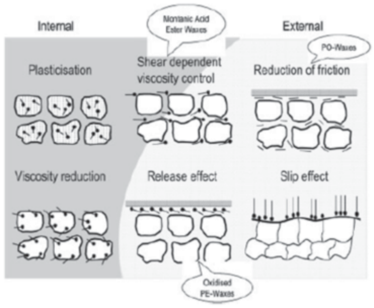

Figure 2: Mode of actions of lubricants

Quick Tests to determine the lubrication effect

The mode of lubrication is largely dependent on its compatibility in the polymer. There are certain tests recommended to study the degree of compatibility measured in terms of some specific property/characterization of the composition.

Torque rheometer studies: External lubrication prevents sticking of the PVC matrix to the walls of the equipment. Thus the fusion time would increase noticeably with the incorporation of an external lubricant. Whereas addition of an internal lubricant would reduce the friction between the polymer chains, thereby resulting in the drop in melt viscosity.

Extrusion studies: External lubricants regulate the fusion, higher crystalline waxes have stronger lubrication power, which results in low pressure and low energy consumption. Internal lubricants increase the pressures and energy, due to their compatibility with polymer. This effect is directly correlated with the polarity and viscosity of the internal lubricant.

Usage of Lubricants in Flexible and Rigid formulations

A plasticizer would normally provide the necessary internal lubrication in a flexible formulation, thus only an external lubricant would probably be required in such a formulation. A rigid composition however would normally require both internal as well as an external lubricant. In most of the cases now the stabilizer one pack comprises the lubrication system as well.

The presence of other additives such as fillers, processing aids, impact modifiers have an impact on the selection of the lubricants.

Some of the typical lubricants used in PVC Formulations include Paraffin wax, Polyethylene wax, Oxidized PE wax, Metal soaps, Fatty Acid Amides etc.

Highlights of MC meetings held in this Quarter

MC meeting Attendees

4th MC meeting for the financial year 2021-22 was held on Thursday 11th March 2022 at 4.00 pm at Goldstab office, Mumbai

Formed a Promotional Committee to undertake projects, campaigns and seminars to promote PVC and its products aimed to remove reservations about PVC and to campaign on PVC products as Preferred Material. Invited TOUCAN – a marketing Agency to give a pre review presentation on how to take it forward. MC decided to start this campaigning with PVC pipe sector.

MC decided to restructure membership fee from April 2022.

5th MC meeting for the financial year 2021-22 was held on Thursday 24th March 2022 at 6.00 pm on the Zoom Platform of IVC

Detailed presentation from TOUCAN to decide master Campaign, few slogans for sub campaign and detailing how to use of Electronic media. MC requested the promotional committee to take feedback from members

MC decided that, for new members joining, the membership fee will be collected on a PRO-RATA basis. For calculations any one joining after 15th of a month, the fee will be calculated from 1st of next month onwards

MC decided to invite project proposals from members in Recycling of PVC waste. IVC will assist with technical feedback and be a facilitator to industry with research or testing institutes

K Value: Significance to PVC Resin

Dr. E Sundaresan
Consultant

Poly Vinyl Chloride resin or PVC as popularly called is the third-most widely produced synthetic polymer after polyethylene and polypropylene. Available in the form of powder, it is always compounded with various additives before processing. This is one unique polymer which can be converted to soft or rigid product based on compounding ingredients.

As, about 57% of the mass of PVC is Chlorine, the presence of chloride groups give the polymer different properties from the structurally close family polymer polyethylene. PVC is highly resistant to oxidation and degradation caused by outdoor exposure due to atmospheric reaction. It has also better flame inhibitor properties.

What is the significance of K value or MFI for Polymers?

These are the indicators of the molecular weight and degree of polymerization in polymers.

K value is an indicator of PVC resin characteristics, similar to the Melt Flow Index (MFI) in case of Polyolefin polymers. However, attempts to measure MFI for PVC is not successful due to the degradation of material and clogging of equipments.

In case of polyolefin, MFI is the weight of polymer extruded in 10 min through a capillary extruder under specified conditions. Whereas, K value in PVC is derived from the efflux of time taken by a fixed volume of PVC solution to pass through a capillary viscometer under specified conditions.

K value is an empirical parameter closely related to intrinsic viscosity, often defined by industries to suggest most suitable application for their resin.

In general, when comparing two PVC resin grades, the resin with higher flow time measured has higher viscosity and hence has higher K value. Higher the K value, higher will be the molecular weight and thus higher mechanicals. Whereas, in case of polyolefins, higher the MFI, lower will be the viscosity, thus lower molecular weight and hence lower mechanicals but easier to process.

Grade choice as per K Value

PVC resins are classified by their K-Value. Among the most common grades - K-57 resin is used for rigid calendaring / sheets and injection moulded fittings, K-67 resin is used for rigid PVC pipes, profiles and soft-films and K-70 for high performance flexible application.

In general, the two important characteristics to be considered in the selection of PVC resin for any particular application are porosity of resin and rheology (the science of deformation of material) of melt.

Higher the K value, higher the porosity. Hence higher K value resins are used for plasticized PVC extrusion application.

However, due to lower diffusivity, the fusion is relatively difficult for high K value resin and hence difficult to process.

In moulding applications, low K value resin due to its lower viscosity generates higher die swell during processing which will give better surface shine to a moulded product.

There is a lot of grade choice in PVC as they cater to variety of applications.

K50-53 are special resins which are tailor-made for some demanding applications. Interesting applications are Battery Separator resins and Blending Resins used along with Paste Grade resin for easy processing.

K55-58 are low K-value ranges which has low mechanical properties but has easy processability. Many applications like injection moulding, blow moulding, calendaring and packaging films are made from the lower K value ranges.

K65-67 are medium K value resin which is the most popular in application. Globally, more than70% of PVC produced is of this class of K value and is consumed by construction and agricultural industry

- They have the right balance of mechanical properties and processability.

K70-73 are high K value resins that give the best mechanical properties but are difficult to process. They need more plasticizer for the same softness. Some popular applications are cable insulation, coatings for conveyor belts, and industrial flooring.

Measurement of K-value

The basis of K value, is the determination of relative viscosity (a synonym for "viscosity ratio") of PVC resin, which is the ratio of the viscosities of the polymer solution and of the pure solvent at the same temperature.

This is the ratio of efflux time between the solution and solvent in a standard Ubbelohde type of viscometer (or suspended-level viscometer) under given conditions. From this we can calculate inherent viscosity, which is the ratio of the natural logarithm of the relative viscosity to the mass concentration of the polymer.

Intrinsic viscosity is calculated extrapolating inherent viscosity to infinite dilution. K value, the industrial representation of molecular properties of PVC resin is calculated from intrinsic viscosity .

ISO 1628 (part 2) is the most common method used by laboratories to measure viscosities and calculate K value. This test method covers the determination of the dilute solution viscosity of vinyl chloride polymers in cyclohexanone. The viscosity is expressed in terms of inherent viscosity (logarithmic viscosity number). The test method is limited to those materials that gives clear, uniform solutions at the test dilution.

The test method requires a 0.2% concentration of PVC solution in Cyclohexanone. Solvent and solution flow times are measured at 30 deg. C using a size I suspended-level Ubbelohde type viscometer. The standard constant temperature viscosity bath having facility to hold viscometer is used to conduct the measurement. The method requires repeat flow times that are obtained within 0.1% precision.

From the ratio of efflux time between the solution and solvent, the intrinsic viscosity and the k value can be read off from the table given in ISO standard.

To sum up, K value (viscosity), is an observed parameter closely related to intrinsic viscosity. This is often defined in slightly different ways in different industries in order to express viscosity based estimate of statistical molecular mass of polymeric material used particularly for PVC.

An Introduction to Plastisols

Ralph Purtell
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Plastisols are a liquid vinyl compound and represent a small and specialty part of the vinyl (PVC) market. From a market perspective, plastisols consume approximately 5% of PVC resins produced and consist of approximately 8% of vinyl compound production. They, plastisols, are used to produce a variety of industrial and especially consumer products.

The PVC resins used to produce plastisols are referred to by many names, including dispersion (D-PVC), emulsion, micro-suspension or paste-making and these terms vary by geographical region. There are a number of aqueous based processes utilized in the manufacture of D-PVC resins, with each polymerization process imparting slightly different characteristics into the resin. Unlike suspension (S-PVC) resins, D-PVC resins consist of 1μ diameter primary particles that are very dense and non-porous. Whereas S-PVC resins are typically 120 - 170μ particles with a range of porosities, with resins for rigid compounds having lower porosity than those resins intended for the production of flexible compounds. (Please note: manufacturers should not be concentrating on the specific D-PVC polymerization process, but rather the performance of the D-PVC resin, with the same being suggested for the selection of S-PVC resins.)

For polymerization purposes, while VCM is "oil", the polymerization of VCM in water (to form the PVC resin particle) requires an emulsifier to maintain particle colloidal stability during the polymerization process step. After the PVC particle is formed, the emulsifier is no longer needed, but remains on the resin surface. While both the S-PVC and D-PVC polymerization processes require the use of emulsifiers, the emulsifiers used are very different in both their chemistry and their usage level. Typically, S-PVC resins contain 0.1 – 0.3% emulsifier with D-PVC resins containing 0.5 – 5.0% emulsifier. The simple explanation for this difference is the average particle size of the resins and the resultant differences in surface areas level required to be enveloped by the emulsifier system, with D-PVC resins having several orders of magnitude more surface area than S-PVC resins.

Compounding the D-PVC resin, with its small average particle size and dense non-porous structure, results in the PVC particles being dispersed in the plasticizer (and other liquid ingredients). While compounding the larger and more porous S-PVC particles results in the compounding ingredients either being absorbed into the resin particle (i.e.: plasticizer) or being deposited onto the surface of the particle, forming a solid (i.e.: powder) compound, which can them be melt-mixed into a pellet or cube, if desired.

By their nature, plastisols require some level of liquid raw materials, such as plasticizer(s). The typical, and somewhat basic, plastisol formulation follows:

Ingredient	Typical Level (phr)	Typical Usage Range (phr)
Resin	100	
Plasticizer	60	20 – 400
Thermal Stabilizer	2	1 – 3
Filler	10	0 – 400
Pigment	1.5	0 – 50
Total	173.5	

While the actual production of plastisols and S-PVC compounds requires different types of mixing equipment, the essence of formulating is the same for both S-PVC compounds and D-PVC plastisols. Plasticizers, or plasticizer blends, are incorporated into the formulation to provide flexibility and elongation. The choice of plasticizer remains the same between the two types of compounds, such as low temperature flexibility, permanence, etc. The same comparisons can be said for the other compound ingredientsutilized in both plastisols and S-PVC compounds. As plastisols are plasticized, impact modifier is not utilized in plastisol formulating, the same as flexible S-PVC compounds. Unlike S-PVC compounds, plastisols also do not require internal or external lubricants, although mold release agents may be incorporated for molding operations such as rotational molding.An important difference in compounding plastisols, versus S-PVC compounds, is the consideration of viscosity or rheology, which can affect the subsequent plastisol processing into the desired end product.

For processing into an end product, the plastisol coats a (temporary or permanent) substrate and is then fused into the final PVC end product. Processing the S-PVC compound involves heating the compound, to form a melt, and then being formed by the extruder or injection molder into the final end product. While S-PVC compound processors are concerned with melt viscosity, plastisol processors are concerned with the liquid viscosity at room temperature, which can change over time and exposure of the plastisol to elevated temperatures. Plastisol formulators must understand the impact of the raw materials and plastisol storage conditions on viscosity and viscosity aging.

The majority of plastisol is processed by the cast coating process, where a layer of plastisol is "cast" on top of a textile, mesh, release paper or other substrate, to produce items such as tarpaulins, resilient flooring tablecloths, etc. Coating thickness is controlled through the use of a floating or fixed knife, reverse roll coater or other "scrapping or leveling" device to form a uniform coating thickness on the substrate. To address potential coating issues, it is important to understand the shear rate being applied to the plastisol at the coating head, which for knife coaters can be estimated by diving the line speed by the coating thickness obtaining a result with the units of sec-1 (watch your units in the calculation!). In most cases, the shear rate at the coating head will be well above the shear rate applied through a Rotating Disc Viscometer (aka: Brookfield® Viscometer, Spinning Disc Viscometer, etc.) testing. Shear rate calculations are available for most plastisol processing systems (i.e.: spray, rotational molding, etc.).

The coated substrate is then fused, which typically occurs at a vinyl film temperature of 350°F (177°C), although this temperature will vary based on the resin molecular weight and the type and level of plasticizer utilized in the formulation. To determine the optimum fusion temperature (where maximum tensile properties are achieved), Tensile versus Time / Temperature studies can be conducted. As the final vinyl film temperature is affected by the process oven temperature and the oven dwell time (a function of line speed), oven temperatures may need to be more than 100°F (55°C) above the optimum fusion temperature. Upon exiting the oven, the film (or part produced through a different process) should be cooled to below 120°F (49°C) before any post operations, such as winding, handling or unloaded, occur.

Like flexible S-PVC compounds, plastisols have a wide range of formulation latitudes and can be adapted to many flexible vinyl products.

Industry Updates

Government notifies the Plastic Waste Management Amendment Rules, 2021, prohibiting identified single use plastic items by 2022.

Thickness of plastic carry bags increased from 50 to 75 microns from 30th September, 2021 and to 120 microns with effect from the 31st December, 2022.

Guidelines for Extended Producer Responsibility given legal force.

- The manufacture, import, stocking, distribution, sale and use of following single-use plastic, including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:-
  - ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration;
  - plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers.

In order to stop littering due to light weight plastic carry bags, with effect from 30th September, 2021, the thickness of plastic carry bags has been increased from 50 microns to 75 microns and to 120 microns with effect from the 31st December, 2022. This will also allow reuse of plastic carry due to increase in thickness.

The plastic packaging waste, which is not covered under the phase out of identified single use plastic items, shall be collected and managed in an environmentally sustainable way through the Extended Producer Responsibility of the Producer, importer and Brand owner (PIBO), as per Plastic Waste Management Rules, 2016. For effective implementation of Extended Producer Responsibility the Guidelines for Extended Producer Responsibility being brought out have been given legal force through Plastic Waste Management Amendment Rules, 2021.

[Extract from Gazette notification of Ministry of Environment, Forest and Climate Changeated:Aug 12, 2021]

Goldstab begins operations in Malaysia

Goldstab Organics Pvt. Ltd, which is one of the largest producer of PVC Stabilizers in India, has announced the commencement of its new production facility in Malaysia. The modern state-ofthe-art plant will manufacture Lead based as well as Ca/Zn based Stabilizers and has a capacity of 18,000 MT/annum.

The plant has a capability of producing high quality Stabilizers for wide range of PVC applications like Pipes and Fittings, Profiles, Wires & Cables, Foam Boards, Flooring among many others.

Explaining the rationale behind venturing into Malaysia, Founder and Director of Goldstab, Mr. Sandeep Shah states that the nearness to the key raw materials like Stearic Acid will render strategic advantage to it's supply chain.

Another important aspect was to go close to the customers in strategically important markets of South East Asia. The 25 year long experience of developing specific customized solutions will be utilized to the offer technically superior products to Goldstab's customers in the region.

INVITING PROJECT PROPOSAL

(FOR MEMBERS ONLY)

IVC plans to undertake projects under its umbrella to promote PVC 'recycling' by existing processing industry or startups

The project: **RECYCLING OF PVC WASTE (Medical, Pharma, Mix etc)**

If any company or association plans to develop a process, product or improve the existing system, in the matter of waste reprocessing may approach IVC for suitable assistance.

IVC can assist and can play the role of a 'facilitator" to carry out the research work at a CSIR lab or at a polymer institute.

Interested industry members can write to IVC for further discussions:
Email ID : **info@indianvinylcouncil.com**

INDIAN VINYL COUNCIL

INDIAN VINYL COUNCIL
Admin. Office : 101/102, Terminal - 9 Building,
Nehru Road, Near Hotel Sahara Star, Vile Parle (East),
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Tel.: +91 22 67489899
Email ID : membership@indianvinylcouncil.com
Website: indianvinylcouncil.com

Reg. No. : GUJ/21190/Ahmedabad (Registrar of Societies)

MEMBERSHIP APPLICATION

Date of application:

Name of the organization : ____________________

Business Address : ____________________

____

City : ____________ Pin : ____________ State : ____________

Tel. : ____________ Email: ____________ Website: ____________

Factory Address (if applicable) : ____________________

____

City : ____________ Pin : ____________ State : ____________

Tel. : ____________ Email: ____________ Website: ____________

Date of Establishment [ ] GST No. [ ]

Category of Business (Please tick mark wherever applicable) (see page 3 and 4 for criteria of type of membership)

☐ Manufacturer of PVC resin ☐ Additives manufacturer ☐ Processor of PVC ☐ Equipment manufacturer

☐ Trader/Distributor ☐ Institution/Association ☐ Consulting firm ☐ Others

Annual Turnover of last financial year Rs. [ ]

Nature of business: [ ]

Name of Authorized Representatives	Designation	Specimen Signature	Mobile No	Email ID
(Principle Member)				
(Alternate Member)				

Category of Membership Applied for (Please tick mark wherever applicable):

☐ Privilege ☐ Associate ☐ Donor

Name of the authorized Person:

SIGNATURE

FOR OFFICIAL USE

Received on: [ ]

Accepted at the Managing Committee Meeting held on [ ]

Sign of Hon. Secretary / Auth. Signatory

Send the filled form along with the cheque to :
Indian Vinyl Council, 101/102 terminal -9, Nehru Road, neat Hotel Sahara Star, Vile Parle (E) , Mumbai 400099 .India

INDIAN VINYL COUNCIL

INDIAN VINYL COUNCIL
Admin. Office : 101/102, Terminal - 9 Building,
Nehru Road, Near Hotel Sahara Star,Vile Parle (East),
Mumbai - 400 099, Maharashtra. INDIA
Tel.: +91 22 67489899
Email ID : membership@indianvinylcouncil.com
Website: indianvinylcouncil.com

Reg. No. : GUJ/21190/Ahmedabad (Registrar of Societies)

FEE STRUCTURE

A) Privilege Members :Individuals in the Business of PVC, Corporate in PVC business , PVC compounders, PVC converters, PVC end product fabricators and any other company engaged in the field of PVC value chain or furthering the object of the Society, may be admitted as Privilege Member

Figures in Rupees

Please tick as applicable category					
Company Turnover	**0-100 Cr**	**100-250 Cr**	**250-500 Cr**	**500-1000 Cr**	**1000+ Cr**
ADMISSION CHARGE	5000	5000	5000	5000	5000
ANNUAL MEMBERSHIP FEE	25000	50000	75000	100000	250000
TOTAL	**30000**	**55000**	**80000**	**105000**	**255000**
ADD GST (18%)	5400	9900	14400	18900	45900
TOTAL	**35400**	**64900**	**94400**	**123900**	**300900**
LESS TDS (10%)	3000	5500	8000	10500	25500
TOTAL PAYABLE	**32400**	**59400**	**86400**	**113400**	**275400**

B) Associate Member: Any society, association, chamber of commerce or other not-for-profit organization, trust, foundation etc. registered as per the applicable law and representing manufacturing industries, service providers, suppliers, end users, dealer etc. belonging to the Vinyl chain from the India, may be admitted as Associate Member of the Society

Figures in Rupees

Membership Fee	**10,000**
One Time Enrolment Fee	**5,000**
Total	**15,000**
Add GST 18%	**2700**
Total	**17700**
Less TDS @ 10% (for F/Y 21-22)	**1500**
Total Payable	**16200**

Above mentioned are Annual fees and become due in April every year.

C) Donor Member: Individuals, firms, trusts, foundations, institutions, bodies corporate or associations supporting or desirous of supporting, or furthering the objects of the Society, may, on payment of the lump sum donations, as is fixed by the Society from time to time.

Donation will be accepted in multiples of Rs 1.0 Lakh and minimum of Rs 5.0 lakhs

Privilege Members of IVC

1. Amisha Vinyls Private Limited
2. Baerlocher India Additives Private Limited
3. Basil Prompt Vinyl Private Limited
4. Bihani Manufacturing Company Private Limited
5. Caprihans India Limited
6. Deceuninck Profiles India Private Limited
7. Finolex Indistries Limited
8. Goldstab Organics Private Limited
9. Indo-Reagens Polymer Additives Private Limited
10. Manish Packaging Private Limited
11. NCL Veka Limited
12. Ori-Plast Limited
13. Platinum Industries Private Limited
14. Quality Speciality Chemicals Limited
15. Reliance Industries Limited
16. The Supreme Industries Limited
17. Theysohn Extrusion
18. PVC Converters (India) Private Limited
19. Pioneer Polyleathers Private Limited
20. Sun Ace Chemical India (Private) Limited

INDIAN VINYL COUNCIL

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GSTIN : 24AABTI 7693 E1ZJ

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