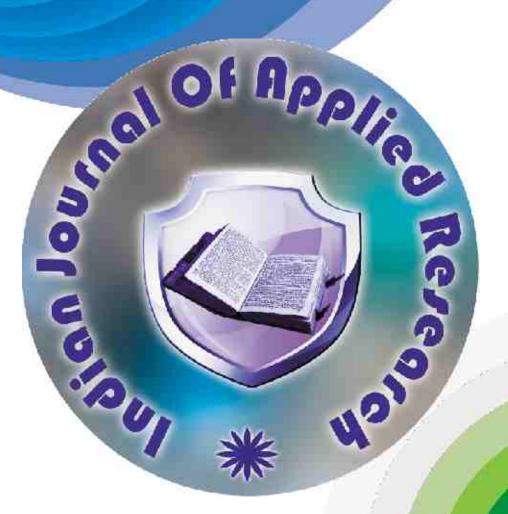
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# Research Paper

# **Engineering**



# Physical And Chemical Testing Of Compounded PVC

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# ABSTRACT

PVC is a thermoplastic resin with a Glass Transition Temperature (Tg) of about 82°C [180°F] and a density of 1.38 g/cm3 [86.15 lb/ft3] that cannot be processed on its own due to its very low thermal stability and high melt viscosity. It is an amorphous linear molecule with small branches. Therefore, it is necessary to prepare an intermediate product where a variety of additives are mixed with the PVC resin to form a "dry-blend" that can be later melt-compounded or processed into a finished article. The unit operations present in the compounding of PVC involve delivering and storage of raw materials, feeding and spraying of all ingredients into a special mixer, mixing and heating the materials to create a dry-blend, then cooling and transferring the dry-blend to storage or to a conversion process such as molding, extrusion or calendaring. Moisture content of raw PVC, sulphated ash content, water absorption behavior has been studied because these are important features that determine end use applications of compound PVC.

Moisture analysis of Compounded PVC is carried in order to avoid splay marks on processing parts, loss on impact and loss of other properties.

The tendency of PVC to absorb water cannot be overlooked since even the slightest amount of water can significantly alter some key mechanical, electrical or optical property. The sulfated ash content test is carried out to indicate the level of known metal-containing additives or impurities in compounded PVC. Chemical resistant testing of sample prepared is also done using different chemicals.

# **Keywords: PVC, Testing**

# Introduction:

VC is a prominent member of large family of plastic materials. PVC is a white granular thermoplastic material. The basic building block for PVC is 'vinyl chloride'. The PVC resulting from the polymerization process is not suitable for processing and must first be compounded to form a useful material. The PVC before compounding can be thought of as similar to flour, by adding various ingredients flour can be used to make for bread, cakes or many other items but on its own the flour is useless. In the similar manner PVC almost always requires conversion into a compound by the incorporation of additives such as heat stabilizers, UV stabilizers, lubricants, plasticizers, processing aids, impact modifiers, thermal modifiers, fillers, flame retardants, biocides, blowing agents and smoke suppressors, and, optionally pigments. Compounded PVC is useful because it resists two things that hate each other: fire and water. used to make raincoats and shower curtains, and of course, water pipes.

#### Methodology:

The compounding process is a first and crucial step prior to the production of any quality PVC end product. PVC resin would not be important in industry without their incorporation of

additives. Hence the importance of compounding additives in the successful production of quality products cannot be overstated.

Table 1: Additive and its Function:

Additives	Properties achieved
Anti-oxidants & other stabilizers	Slow down the rate at which the polymer will be degraded by oxygen, heat, visible light or UV radiation
Compatibilizers	Enable PVC to be mixed with other plastics and helps plastic recycling
Flame retardants	Reduce flammability of plastic
Pigments	To colour the plastic
Plasticisers	To produce flexible and manageable plastic
Impact modifiers	To absorb shock without damage
Fillers	Inexpensive, inert materials that simply add bulk to the plastic

### Testing of PVC compound:

1. Sulphated ash content of raw PVC resin

Firstly we take a silica crucible and heat to redness for 10 minutes. Allow it to cool in desiccators and weight.

Transfer 1 gm of the substance to the crucible and Cool and moisten the residue with 1 ml of sulphuric acid, weight the crucible.

Then ignite gently at first, until the substance is through charred. Heat gently until the white fumes is no longer evolved and ignites at 800°C until all black particles have disappeared.

Conduct the ignition in a place protected from air currents. Allow the crucible to cool.

Add a few drops of sulphuric acid and heat. Ignite as before allow to cool and weight repeat the operation until two successive weighing do not differ.

#### 2. Water absorption test

The tendency of PVC to absorb moisture cannot be overlooked since even the slightest amount of water can significantly alter some key mechanical, electrical or optical property. The test to determine the water absorption of PVC is as follows:

Firstly we take a silica crucible and heat to redness for 10 minutes. Allow it to cool in desiccators and weight.

Transfer the test specimen to the crucible and dried in a desiccators over calcium chloride for24±1 hour. It is then weighed after its removal from the desiccators.

Specimen is then immersed in distilled water at 50±2°C for 48+1 hour

After this, specimen is immersed in water at ambient temperature and cooled for 30±15 minutes, dried with filter paper and within 5 minutes, it is again reweight.

#### 3. Moisture analysis

The hygroscopic nature of PVC causes processing as well as dimensional stability problems. Moisture analysis of Compounded PVC is carried in order to avoid splay marks on processing parts, loss on impact and loss of other properties.

Firstly we take a silica crucible and heat to redness for 10 minutes. Allow it to cool in desiccators and weight.

Transfer approximate 1 gm of the substance to the crucible.

Keep the crucible in an oven maintained at a temperature of 105±2°C for 1 hour.

The crucible is then removed from the oven and place in a desiccator for 30 minutes and allows to cool.

#### Calculation:

## 1. Sulphated ash content:

Formula Used:

Sulphated Ash 
$$\% = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

Where

W<sub>1</sub> = Constant weight of empty silica crucible

W<sub>2</sub> = Weight of silica crucible with sample before

heating

W<sub>3</sub> = Weight of silica crucible with sample after

heating

 $W_2 - W_1 = Weight of sample initially taken$  $W_2 - W_3 = Loss in weight after heating$ 

#### 2. Water absorption test:

#### REFERENCES

Formula Used:

Water absorption 
$$\% = \frac{W_3 - W_2}{W_2 - W_1} \times 100$$

Where W<sub>1</sub>

= Constant weight of empty silica crucible

W<sub>2</sub> = Weight of silica crucible with sample before

immersion into water

W<sub>3</sub> = Weight of silica crucible with sample after

immersion into water

 $W_2$ - $W_1$  = Weight of sample initially taken

 $W_3$ -  $W_2$  = Increase in wet due to water absorption

#### 3. Moisture analysis:

Formula Used:

% of moisture = 
$$\frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where

W<sub>1</sub> = Constant weight of empty silica crucible

W<sub>2</sub> = Weight of silica crucible with sample before

heating

W<sub>3</sub> = Weight of silica crucible with sample after

heating

 $W_2 - W_1 = Weight of sample initially taken$  $W_2 - W_3 = decrease in wet due to moisture$ 

Results and Discussion:

 Sulphates Ash %
 =
 0.08%

 Water Absorption %
 =
 0.34%

 % of moisture
 =
 0.13%

Table 3: Results of Immersion test

#### (+) Denotes resistance and () Not resistance

		•	
S. No.	Name of chemical	Observation	Result
1.	Hydrochloric acid-20%	No significant weight change	+
2.	Sulphuric acid -20%	No significant weight change	+
3.	Nitric Acid over-50%	Weight change	-
4.	Sodium Chloride	No significant weight change	+
5.	Glacial Acetic Acid	weight change	-
6.	Gasoline	No significant weight change	+
7.	Acetone	Dissolve	-
8.	Toluen e	Dissolve	-
9.	Xylene	Dissolve	-
10.	Soap and detergents	No significant weight change	+

# Conclusion

The data sheds light on the performance of the materials in water or humid environments.

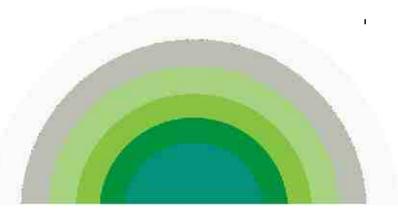
These results show that Compound PVC prepared in this study can be use for water piping, Waste water pipes, grating covers, guttering, drain pipes, waste water fittings, roofing sheets etc. since the water absorption material is considerably lower

Compound PVC is highly resistant to attack of inorganic acids, alkalies and many organic acids. Exceptions are hot nitric acid of concentration above 50%, highly concentrated oxidizing acids. Attack consists of the surface rather than penetration hence can be used for oil and beverage bottles.

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