GEL TIME STUDIES IN ACTIVATION OF POLYESTER RESINS

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Gelling times of polyester resins with varying quantities of catalyst and accelerator were studied and the results reported in this communication.

INTRODUCTION:

Polyester resins reinforced with fibreglass chopped strand mat when cured fully forms an ideal sheathing material for wooden fishing boats(Balasubramanyan 1971 a,b) However, the slow and poor air-curing characteristics of the polyester resins necessitates forced curing with heat or high catalyst and accelerator concentrations at the time of application during sheathing of wooden hulls and fish-hold surfaces. The right method of compounding polyester resins is an important factor which decides the quality of the finished product as well as the quickness with which the job is satisfactorily completed. The process of converting polyester resins from liquid state to the solid state as is required once the reinforcement of fibreglass into the resin has been made, involves a chain of chemical reactions (co-polymerization). This activation of the resin is brought about at room temperature by the addition of organic peroxides and certain metal soaps in predetermined proportions (Jaganathan 1970). The co-polymerization proceeds with the evolution of self-generating heat and the liquid polyester is slowly converted into a hard cross-linked material. The whole process is controlled by the quality of accelerator and catalyst added to the mass of unsaturated polyester resin at a known temperature and relative humidity of the atmosphere.

EXPERIMENTAL DETAILS

With a view to predetermining the probable gel time of the polyester resin, a series of investigations were undertaken. Varying proportions of accelerator (*Ethyl methyl ketone peroxide*) and catalyst (*Cobalt naphthenate*) ranging from 1 to 2% were added to a known quantity (100g) of isophthalic polyester resin in separate lots and the gelling time in each case was carefully noted. During the current observation, temperature was constantly maintained at 30°C with 76% relative humidity. The details are furnished in table I.

Table I Critical gel time obtained with activated isophthalic polyester resin.

Atmospheric Temperature: °C	Relative humidity %	Quantity of polyester resin: g.	Quantity of accelerator: ml.	Quantity of catalyst: ml.	Gel time: minutes	Remarks
30	76	100	1.0	1.0	46	Process adopted during the present sheathing
,,	,,	,,	1.5	1.5	18	Not adopted
,,	,,	,,	2.0	2.0	10	Too short a time for field work and hence deliberately avoided.

Discussion

Keeping the factors like working temperature, relative humidity and the mass of resin constant but suitably altering the proportion of accelerator and catalyst mix to resin, three different rates of gel times were obtained as is seen from the table. An increase of accelerator and catalyst by 50% in the resin mix alone, reduced the gelling time by 28 minutes and when doubled, it further reduced to 10 minutes both of which are too short a time limit for the handling of the activated polyester resin in the sheathing of wooden boat hulls with fibreglass. 46 minutes of safe working time was obtained with the addition of only 1% of accelerator and 1% of catalyst to the resin. One kilogram lot of activated resin mix was found to be a convenient quantity to handle at a time without both loss of time and materials. Further, slight increase or decrease in the gel time was also possible with the decreasing or increasing of the working temperature. But a temperature of 30°C appears to be the normal working condition that prevails for most of the period in and around Cochin during the non-rainy season. For purposes of storage of the unsaturated polyester resins without the accelerator and the catalyst this temperature of 30°C appears to be rather on the high side.

When the present quality of the unsaturated and unactivated polyester resin was stored in a tightly closed tin container and kept in an air-conditioned room at 24°C, the resin was sound and stable for use even after 6 months. Thus, it is clearly seen that the normal gelling time of the polyester resins under activation can be manipulated to some extent suiting the actual working conditions by regulating the quantity of accelerator and catalyst required. At the same time atmospheric temperature and relative humidity also seem to play an important role both under use and storage. The present basic data may be a guiding factor while working with FRP sheathing in open air under shade adopting hand-lay-up process.

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