CHARACTERISTIC AND FAILURE ANALYSIS OF FRP COMPOSITE TANK USED FOR SODIUM HYPOCHLORITE (NaOCL) STORAGE

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Abstract- The topic of the manufacturing process of chemical storage tank and its cause of failure is totally based on the working of individual process of every step and the study of the material use in the whole process. This topic is base on the working process of chemical storage tank and what failure takes place during the load acting on the tank, where as it gives manufacturing process step by step in the formation of tank.

Now days several industry face the problem of leakage of chemical from the tank, these thing also face by bhavi plast pvt.Ltd. Where there are no criteria for the consumption of raw material and also no specific method to use the raw material in the formation of chemical storage tank. Aim is how to minimize the leakage of the tank and also proper method for the use of raw material. Make a job card for chemical storage tank and give every individual step to its own consumption of the raw material. Some leakage of the tank is also based on the mechanical property of the material, its stress strain curve and calculation of the failure stress. So for the study of these type of thesis is required deeper

Knowledge of the subject along with the practical knowledge as well. Due to the failure of the tank annually plethora amount of money waste in to the various industries. Useful knowledge and deeper understanding improve the productivity of the product and errorless chemical storage tank manufacture in to the industry.

Keywords-Chemical storage tank process, cause of its failure

Introduction-Fiber reinforced plastic is important part in the chemical storage tank, different type of plastics used in the formation of chemical storage tank.FRP (fiber reinforced plastic) is the combination of the resin and the mat , it combine together and form the FRP layer construction which is used in the layering of tank of shell, top, and bottom. Before applying FRP layer we have to join sheet by welding process and then carbon putty for spark testing. The whole process is applied for individual part of the tank. The whole process is very important for the leaking detection; main work of the tank for storing chemical is free from leakage.

Other part of the chemical storage tank is their study of mechanical property; during the study of the tank every material should work under its fracture load. Other reason behind the leakage is property of the raw material use. We should insure tank is working properly under its given circumstances.

Analysis of the resin by practical and Manual.

Manual calculation of resin and mat for 5kl chemical storage tank

$$Bottom\ area = \frac{\pi}{4} \times 1.48^2 = 1.7195m^2$$

CSM required at bottom area 1.7195×.45×8=6.1

$$shell\ area = \pi \times d \times l = \pi \times 1.48 \times 3 = 13.94$$

CSM required at shell area

13.94×.45×4=25.09kg

$$TOP\ OR\ CONICAL\ SURFACE\ AREA = \pi \times r \times l = \pi \times .74 \times .766 = 1.78$$

CSM required at conical area

1.78×.45×6=4.8kg

TOTAL CSM REQUIRED 6.19+25.06+4.8=36.05kg.

TOTAL WRM REQUIRED

13.942×.61×2=17kg.

TOTAL RESIN REQUIRED

(36.02×2.02)+(17×1.6)=100.021kg.

Practical consumption of resin and mat

Total CSM required=32kg.

Total WRM required =14kg. Total resin required =94kg.

Table 1.1 Material consumption table

MATERIAL OF CONSTRUCTION	ACTUAL CONSUMPTION(kg)	THEORETICAL CONSUMPTION(kg)
CSM	32	36.05
RESIN	94	100.02
WRM	14	17

Analysis of its cause of failure-

Test for Fiber Reinforced Plastics (FRP) (ASTM D5868

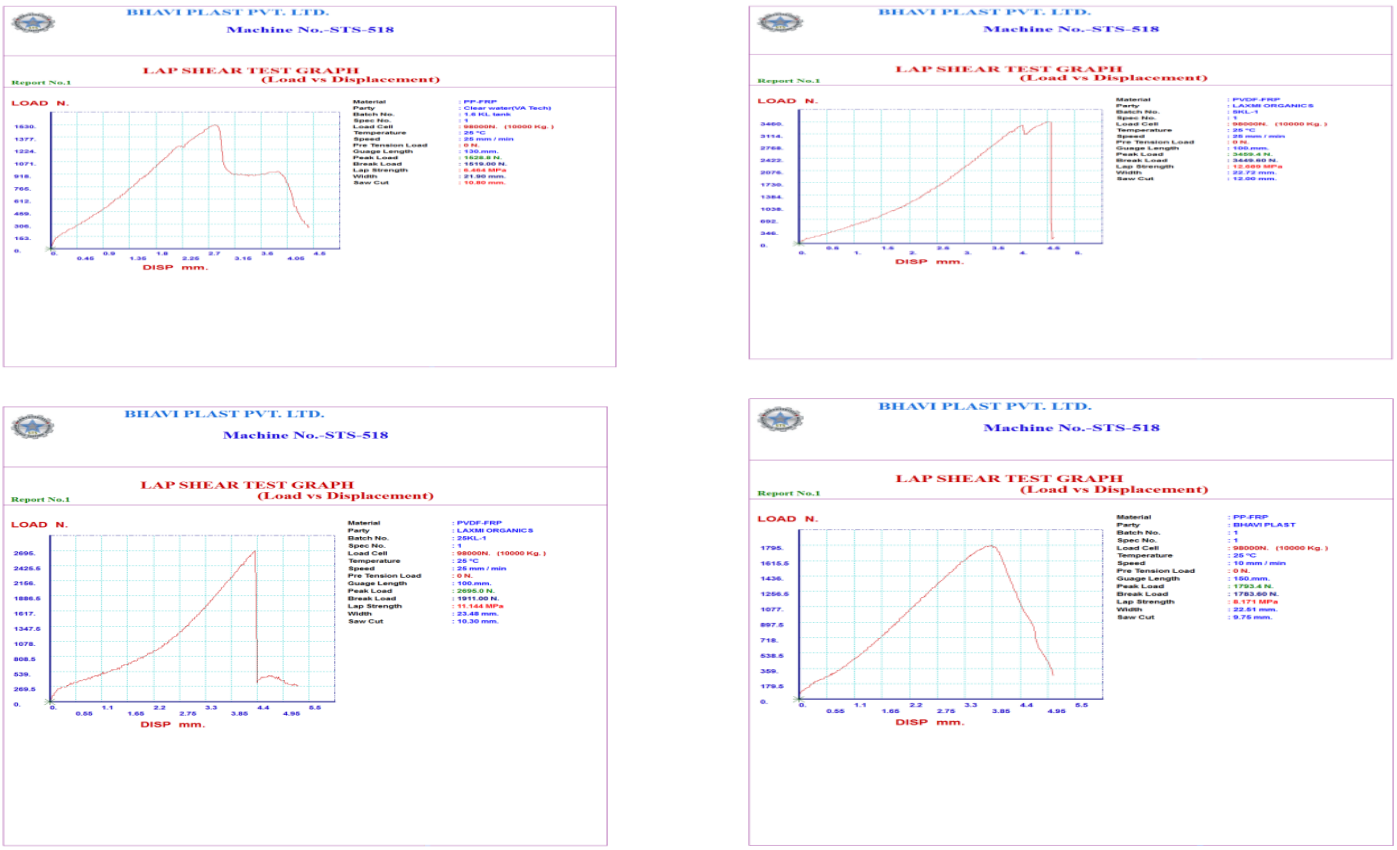

Fig. 1.1. Lap shear test diagram

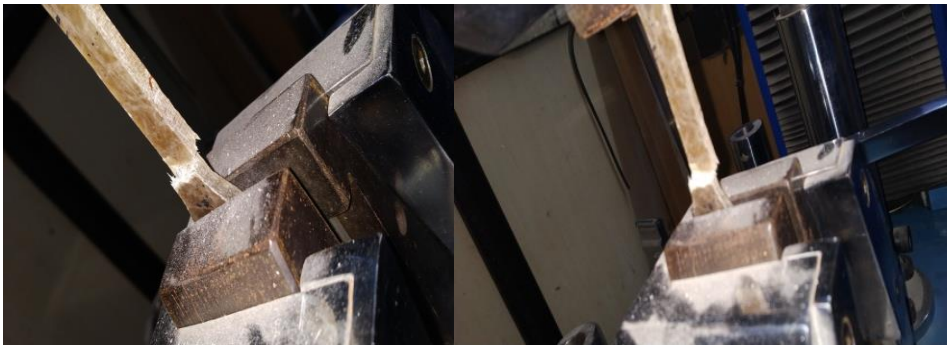

Fig. 1.2. Fracture on lap shear test diagram

Fig. 2.1. Peel test diagram

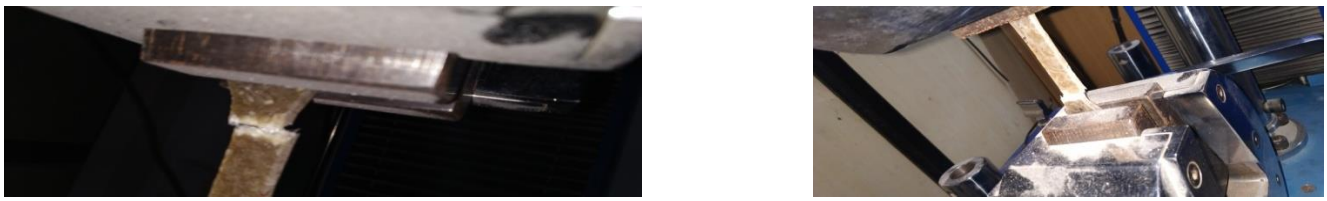

Fig. 2.2. Fracture on peel test diagram

Fig. 3.1. Tensile test diagram

Fig. 3.2. Fracture on tensile test diagram

After completing the tensile test I get following fracture load and safe load for avoid the tank failure.

Table 1.2 peel strength table

SR.NO.	Max load(N)	Breakload(N)	Gauge length(mm)	Peel strength(N/mm)	Elongation(mm)
1	384.16	383.18	22	17.462	2.07
2	344.96	343.98	69	16.91	4.1
3	355	6	78	22.3	4.5
4	564.872	563.01	226.2	25.746	5.76
Mean value	412.25	410.54	98.8	20.6	4.1
Std.deviation	89.28	89.23	76.56	3.63	1.33

Table 1.3 tensile strength table

SR.NO.	Max load (N)	Break load (N)	Gauge length(mm)	Tensile strength(MPa)	Elongation (mm)	Peak time(sec)	Break time(sec)
1	20364	20246.8	130	196.223	10.75	1277	1279
2	16836	9035.6	110	171.116	7.88	471	472
3	15000	13446.2	92	163.23	6.9	432	431
Mean value	17400	14242.86	110.67	176.85	8.51	726.67	727.33
Std.deviation	2226	4611.49	15.52	14.06	1.63	389.47	390.44

$\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}$ i=1 to N

$\mu = mean$ of all value

N=total no. Of value

RESULT AND DISCUSSION

Surface crack take place due to the raw material misguidance. I calculate the raw material consumption by practical and manually which too much variation; this may be the one reason behind the leakage. I study thoroughly about raw material consumption in chemical storage tank and concluded that how much variation we can take

Other part of the thesis is mechanical property of raw material; I calculate the breaking load and the strength of the particular material by universal testing machine and get the fracture load of the material. Maximum load and fracture load by peel and tensile test is given below in the figure

The consumption of the process is given in the below table.

Table 3.1 Raw material consumption record

Material of construction	Actual consumption(kg)	theoretical consumption(kg)
CSM	32	36.05
RESIN	94	100.02
WRM	14	17

Table 3.2 Peel test record

SR.NO.	Max load (N)	Break load (N)	Gauge length(mm)	Peel strength(N/mm)	Elongation(mm)
Mean value	412.25	410.54	98.8	20.6	4.1
Std.deviation	89.28	89.23	76.56	3.63	1.33

Table 3.3 Tensile test record

SR.NO.	Max load (N)	Break load (N)	Gauge length(mm)	Tensile strength(MPa)	Elongation(mm)	Peak time(sec)	Break time(sec)
Mean value	17400	14242.86	110.67	176.85	8.51	726.67	727.33
Std.deviation	2226	4611.49	15.52	14.06	1.63	389.47	390.44

Table 3.4 Shear test record

SR.NO.	Max load (N)	Break load (N)	Gauge length(mm)	Peel strength (MPa)
Mean value	**2585.32**	**2421.04**	**122**	**9.99**
Std.deviation	**808.34**	**846.22**	**19.39**	**2.28**

CONCLUSION

From the following calculation we see that actual resin consumption is less compare to what we accept to consume by 5kl tank. Though we can see that one of the main concerns of the erosion of the tank is their less strength with respect to their material of construction. Early degradation of the tank may take place if we use less material of construction. So degradation and the leakage is due to the misjudge of raw material. Which is minimize By the practical studies and comparison of the both raw material consumption. From the above discussion of tensile test and mechanical properties and their behavior represent that we have to work under the limit of failure and take some factor of safety as well. One of the reasons behind the failure of the tank is mechanical properties of the material.

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