PROTECTION AGAINST RAIN PENETRATION IN MASONRY WALLS

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METALLIC soaps, formed by the combination of fatty acids with metals such as calcium and aluminium, are water insoluble and are used in one form or the other for waterproofing brick masonry. In this article laboratory and field studies carried out at the Institute on the use of soap and alum solutions for waterproofing brick masonry are described.

Laboratory studies

The materials used in laboratory studies were :

(i) Burnt briquettes 3 in × 2 in × 1½ in. These were used in place of full size burnt bricks for convenience. Briquettes after drying at 40 ± 5°C, when placed with the flatside in ¼ in of water (corresponding roughly to the pressure exerted by a 20 mph breeze[1]), showed moisture absorption at 8·54 per cent in 30 minutes, 16·48 per cent in 1 hour, 22·10 per cent in 2 hours, and 22·72 per cent in 24 hours.

(ii) Sunlight soap—A product of Hindustan Lever Ltd.

(iii) Alum (C.P.)

Determination of optimum strength of soap and alum solutions

The limits of the strength of the soap and alum solutions to be tried were fixed between 2·5 to 7·5 per cent and 1 to 2 per cent, respectively[2].

A 2·5 per cent soap solution was warmed and applied while hot by means of a brush over the flatside and the four edges of the dried briquettes. The soap solution sank into the pores. The briquettes were dried, and a 1 per cent hot alum solution applied over the soap treated surface, and allowed to dry. In this way 3 alternate coats of 2·5 per cent soap solution and 1 per cent alum were applied. The briquettes were dried, weighed and tested for moisture absorption, measured by placing the flatside of the briquettes in ¼ in of water and noting the increase in weight after 30 minutes, 1 hour, 2 hours and 24 hours of immersion.

Different sets of briquettes were similarly treated with 5 and 7·5 per cent soap solutions and 1 per cent alum solution and 2·5, 5 and 7·5 per cent soap solutions and 2 per cent alum solution, and the moisture absorption test carried out. The results are shown in *Table* 1. It would appear from the results that there is no appreciable difference in moisture absorption when 1 per cent and 2 per cent alum solutions are used. There is also not much reduction in moisture absorption by increasing the strength of the soap solution from 5 to 7·5 per cent.

TABLE 1. Moisture absorption of treated briquettes

Strength of soap solution, per cent	Strength of alum solution, per cent	Moisture absorption, per cent			
		30 min	1 hr	2 hr	24 hr
2·5	1	0·86	2·15	4·55	6·91
5·0	**1**	**—**	**0·45**	**1·35**	**2·23**
7·5	1	—	0·75	1·82	2·12
2·5	2	0·85	2·35	4·70	6·36
5·0	2	—	0·83	1·11	2·00
7·5	2	—	1·18	1·85	2·14

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The combination of 5 per cent soap solution and 1 per cent alum solution being more suitable was, therefore, chosen for further work.

Determination of optimum number of coats

The results of experiments to determine the number of coats of soap and alum solutions which should be applied for satisfactory working are given in *Table* 2. It would appear that with each coat the moisture absorption is reduced. Since the fourth alternate coat does not reduce it much, the number of alternate coats were limited to three from the point of view of economy.

TABLE 2. Effect of number of coats on moisture absorption

Number of alternate coats	Moisture absorption, per cent			
	30 min	1 hr	2 hr	24 hr
Nil	8·54	16·48	22·10	22·72
One	7·11	8·60	10·36	13·66
Two	2·60	3·46	4·72	6·51
Three	—	**0·45**	**1·35**	**2·23**
Four	—	0·89	1·57	2·02

Durability test

The durability test consisted in studying the effect of alternate wetting and drying cycles. In all 30 cycles were carried out, one cycle consisting of 6 hours of wetting followed by 18 hours of drying at 40 ± 5°C. The percentage moisture absorption of the briquettes before and after cycles was 2·23 and 2·30.

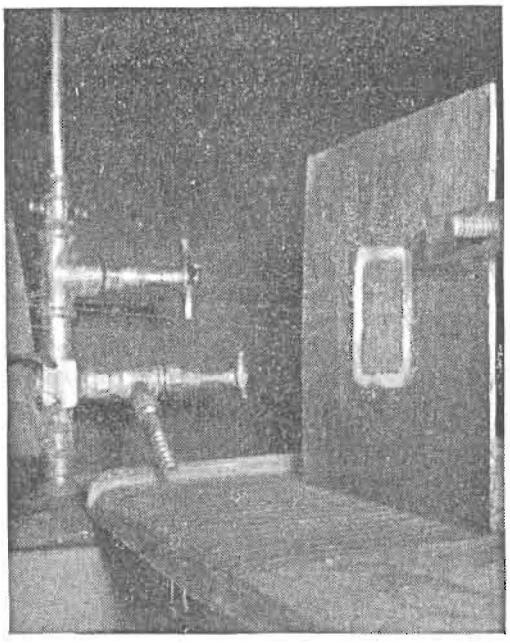

Fig 1. Laboratory improvisation for the rain penetration test.

sistance to rain penetration

The resistance of the treated briquettes against rain pene-
ıtion was determined by subjecting them to artificial rain.
ıe volume of water falling over the briquettes was approxi-
ıtely 0·2 litres per minute and the spraying was continued
· 144 hours. The arrangement for carrying out the test is
own in *Fig* 1.

It was found that no moisture penetrated to the back of
e treated briquettes in 144 hours of continuous spray.
ıtreated briquettes when similarly sprayed showed the
›pearance of moisture at the back in 8 to 10 minutes.

eld experiments

A panel of burnt bricks 6 ft high, 4 ft wide, and 9 in thick
ıs built over a *pacca* foundation provided with a damp-proof
·urse using 1 : 6 cement-sand mortar. The same mortar was
·ed in pointing the joints. After drying in the sun for about a
onth, three alternate coats of a hot 5 per cent soap solution
ıd a hot 1 per cent alum solution were applied over one face
the panel with an interval of 24 hours between alternate coats.
his period was considered desirable for the complete drying
the wall.

It was observed that the colour of the wall face became
ightly whitish after the treatment.

ain penetration test

The panel after treatment was allowed to dry completely
ıd was then subjected to a rain penetration test. The arrange-
·ent is shown in *Fig* 2. Precautions were taken to protect the
›p and sides and limit the spray to the panel.

The rate of spraying was maintained constant at one gallon
ır minute, which is roughly equivalent to a rainfall of 3 to 4 in
ır hour falling over the face of the panel at an angle of incidence
f 45°. The distance between the sprayer and the face of the
anel was 3½ ft.

The spraying was continued for 6 hours (equivalent to 18
› 24 in of rain) and it was observed that there was no pene-
·ation of moisture at the back. In the case of an untreated
anel similarly sprayed moisture appeared at the back in 1 hr
ıd 10 min.

Conclusion

The study carried out shows that external brick masonry
ın be effectively treated against moisture penetration by giving
·ree alternate coats of 5 per cent soap solution and 1 per cent
lum solution. The process has the advantage of being cheap and
f using indigenous materials which are easily available. To

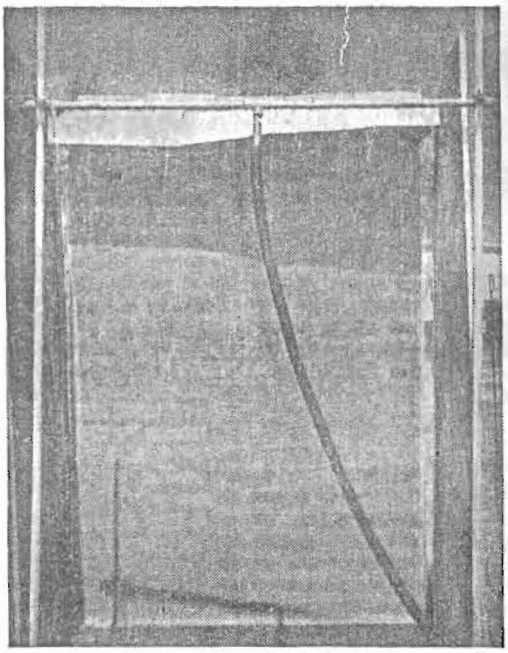

Fig 2. The rain penetration test on a field scale.

get the best results it is necessary to point out that the atmospheric temperature should not fall below 50°F during the time the coats are being applied, as complete success depends to a great extent on the preservation of warmth while the changes between soap and alum are taking place. For the same reason the solutions should be hot when applied.

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