# surface sizing of paper and board with cmc

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*The behaviour of paper and board with the CMC additive is explained here. An idea of their reaction in the printing operation has also been given.*

Carboxy methyl cellulose, commonly known as CMC is a very well known chemical additive to paper-making stocks. It can be used in beaters, to the paper web at the size press for surface sizing or "low-coating" or in off-machine coating compositions. This article is presented to serve a two-fold objective :

(i) To understand the technology of size-press addition of CMC and

(ii) To correlate the Wax Pick Number of board to the viscosity of CMC solution.

**I. Surface sizing with CMC :—**

The following fundamental requirements should be fulfilled for surface-sizing with CMC at the size-press for an optimum effect on the surface :—

| | |
|---|---|
| Dry content of paper before size-press ... ... | over 90% |
| Hardness of Size Press rolls (Bottom roll rubber covered) ... (The roll should be doctored in case of on-machine coating) | 25—35 P&J |
| Linear pressure at the nip ... | 15—17 Kg/cm. |
| Viscosity of a 2% CMC solution ... | about 100 cps. |
| Degree of substitution of CMC ... | above 0.8 |

Under such optimum conditions, CMC gives the following advantages in the surface characteristics of paper or board :—

(a) To reduce fluff, linting and fuzziness of board or paper and thereby improve the printing characteristics of the surface, particularly in the case of off-set printing.

(b) To increase Wax-pick by increasing the surface strength and to control the oil absorbency.

Frequently, a wax emulsion of 0.5% concentration is added to obtain a higher gloss and a lower cobb value of the board.

CMC thus reduces the oil absorbency of the liner which causes a higher gloss of the print. However, a simple surface treatment of the board with CMC is not often enough for a better varnishing and one has to resort to a "low-coating" on the machine.

**On-machine coating :**

In a "low-coating", the CMC is combined with pigments and other adhesives, and, in this way, a surface more susceptible to printing ink is obtained. The colours appear with greater clearness and contrast effect on the paperboard. Furthermore, an improved varnishing and waxing of the paperboard will be obtained.

A typical coating mixture for on-machine coating (used in a mill in Sweden) is given below :

100 parts china clay.

0.3 parts calgon (based on weight of china clay)

Alkali sufficient to bring pH of pigment slurry to pH 8.5—9.0.

10 parts CMC (of low viscosity ca., 20—40 cps.).

0.3 parts optical bleach.

15 parts plastic emulsion of 50% concentration.

Total dry substance of the prepared mixture was about 34%. Coating weight on board was 2 to 5 g/m$^2$.

Board after coating is being used for off-set printing.

**Preparation of coating mixture :**

The dispersing agent and the alkali are added first to the proper quantity of water. As dispersing agent calgon (Sodium hexametaphosphate), may be used in a quantity of 0.5 parts per 100 parts of pigment.

The alkali may conveniently be added as concentrated caustic soda solution and in an amount sufficient to bring the pH value of the pigment slurry upto 8.5—9.0. To attain this pH value, an addition of about 200—300 ml. of concentrated caustic soda solution for each 100 kg. of china clay is required.

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The pigment is dispersed in the solution of dispersing agent and alkali, preferably kept at a temperature of 50—55°C. Then CMC of low viscosity (20—40 Cp) is added, and finally, when the coating mixture has attained a smooth consistency, the plastic emulsion is added. In order to prevent precipitations on the size press, cold water should be used in cleaning the press rolls.

**A few important factors to be maintained at the size-press for coating :**

(a) Ensure a uniform pool of coating to the nip on the bottom roll.

(b) A few general modifications to regular size press practice may become necessary or desirable in handling the moist coated sheet after it emerges from the nip. The usual precautions taken at this point are to prevent any coating of the first drier roll of the size press drier section. The object here is to give the moist coating a treatment to allow a slight presenting before it is applied to the first drier.

An extension of draw at this point or an application of warm air to the moist sheet are the usual means employed.

(c) Higher moisture contents than 3-5% in the raw sheet can cause "bagging" with vertical size presses and cockling and puckering, if the moist coated sheet is not dried slowly.

(d) Internal sizing of raw board should be "medium", such a way that the sheet does not 'Steal' too much of adhesive, yet does not prevent pick up of the desired coat weight.

## II Correlation of Wax Pick of board to the viscosity of CMC solution :

Based on the above general theory of working with CMC, trials were conducted on a board machine in India to find the optimum conditions of application of CMC at the size-press.

Duplex board of a substance of 250-260 g/m$^2$ was run on the machine.

CMC (cellpro LVB) was used for these trials. A 2% solution of this quality had a viscosity of 90—100 pcs. Viscosities were measured with a Brookfield Viscometer, (Spindle No. 2 at a speed of 100 r.p.m.). The trial was done with different viscosity solutions of CMC from 20 cps. to 100 cps.

Wax Pick Number determinations were done on the board with Dennison Standard Waxes.

**Conditions on the machine :**

Furnish : Bamboo (90%) and Wood Pulp (10%) for top liner.
Clay : 10%

| | | |
|---|---|---|
| Freeness of stock | ... | 35 — 40°SR. |
| pH in Head Box | ... | 6.6 |
| Qualities run | ... | White Duplex and Yellow Duplex. |
| Moisture in Board before size-press | ... | about 12% |

Hardness of size-press rolls—Top—32 P & J Bottom : 25 P & J.

The trials were conducted for a period of 36 hours and the machine conditions were kept uniform as far as possible.

**Results and Discussion :**

(a) **Wax Pick Number :**

From Fig.-1, it is clearly seen that with increasing viscosity of CMC solution, the wax pick of the board has also risen correspondingly. At a viscocity of 80-95 cps., the maximum Wax pick number of 8A-9A was achieved for the board as against a value of 3A-4A without any CMC.

Higher viscosities could not be studied as there was a tendency for the CMC to form a gel and the pump could not be operated at such high viscosities.

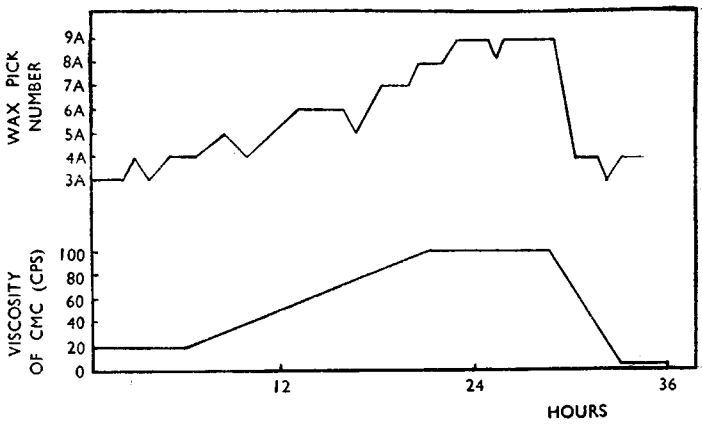


FIG. 1 : Viscosity of CMC and Wax Pick Number of Duplex Board.

(b) **Printing :**

The following table shows the results of printing on four types of boards :

(i) White Duplex Board without CMC (Control 1).

(ii) Yellow Duplex Board without CMC ( Control 2 ).

(iii) White Duplex Board with CMC.

(iv) Yellow Duplex Board with CMC.

Printing was done on a laboratory size Japanese offset printing machine with manual feeding system.

A definite weight of printing ink ( 25 g. of Ganges Scarlet ) was taken in each case and printed on sheets of 14″ × 22″ and the number of sheets that could be printed with that weighed amount of ink was recorded. It was found that no appreciable difference in the number of sheets was observed in any of the four cases, thereby indicating that the ink-holdout was more or less the same in all the four cases.

However, a significant improvement was observed in two directions : (a) quality of printing and (b) Fluff on the rubber blanket. The sheets printed on board with CMC had a better and harder surface, giving a more uniform printing and high gloss. There was also practically no fluff on the blanket even after printing 70-75 sheets, whereas in the case of board without CMC, fluff appeared on the blanket already after printing 18-20 sheets only.

TABLE

*Printing Results.*

Printing ink used : Ganges Scarlet.

| Quality | Additive | No. of sheets printed | Gms of ink per ream. | Fluff on blanket after No. of sheets. | Remarks on quality of printing |
|---|---|---|---|---|---|
| White Duplex | Nil | 69 | 182 | 20 | Poor—No glaze MG lines exposed. |
| Yellow Duplex | Nil | 67 | 187 | 18 | |
| White Duplex | CMC | 74 | 195 | No fluff | Better and harder surface; uniform printing; No lining. |
| Yellow Duplex | CMC | 72 | 190 | No fluff | |