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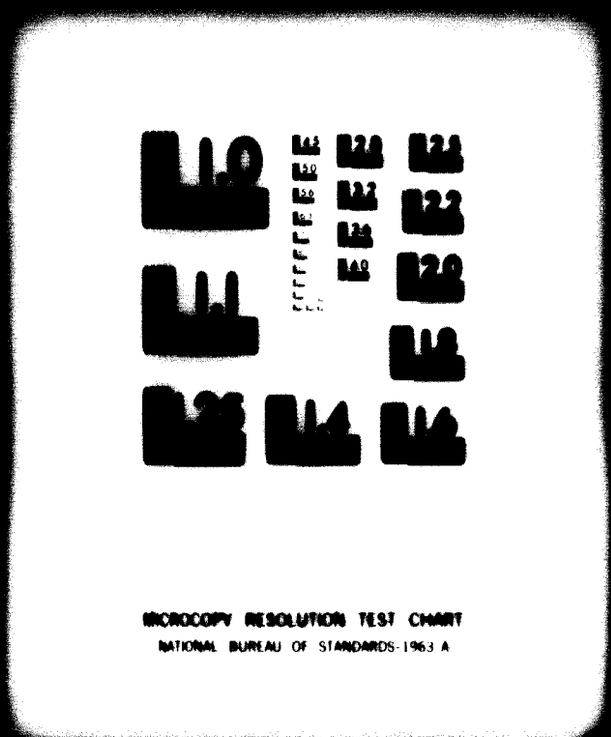

FINAL REPORT

Unido Contract 71 / 24
Project 69 / 658

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Received 26.2.70

F I N A L R E P O R T

UNIDO CONTRACT 71 24

Project No. SIS 69/658

Assistance in the Manufacture

of Transparent Film at

MISRATEX, KAFR el DAWAR, UAR

[redacted]

INDEX

[redacted]

1. INTRODUCTION

The present final report is made in accordance with para. 2.08c of the contract signed between UNIDO and ING.A.MAURER S.A. Berne, 10.5.1971.

The scope of work according to contract provides services of assistance to MISRATON CO. in Kafr-el-Dawar UAR in the manufacturing of Transparent Paper.

Detailed services according to contract are stipulated as follows:

a) advise on the steps necessary to bring existing production of cellophane film up to a standard competitive with good quality European production;

b) advise on the incorporation of an "anchor coat" in the cellophane film so that it is suitable for coating either with a nitrocellulose-based composition to give a high quality coated film, or with polyvinylidene chloride plastic should this type of coating be required at a future date;

c) supervise and advise on the coating with nitrocellulose materials, taking into account the recommendations already made for improving this part of the process;

d) provide detailed formulae and technologies -

   i) for manufacture of moisture-proof, heat-sealing, anchored transparent cellophane on casting machine; and

   ii) for viscose manufacture solutions.

It was suggested by MAURER to divide the work into two field working periods, and the contract has been made accordingly.

[redacted]

This suggestion had found full approval of MISRATON's management and proved to be beneficial for the work.

The first field working period of the expert was from May 13th - June 11th, and the second from October 17th - November 30th.

Briefing and debriefing in Vienna was done on May 12th respective December 1st and 2nd, 1971.

This report gives a resumé of the daily discussions, suggestions, trials and conclusions. The remarks made in the UNIDO Interoffice Memorandum dated 19.7.1971 have also been taken into consideration.

The expert also wishes to express his gratitude for the excellent co-operation with all the staff at MISRATON during his stay at the plant.

[redacted]

II. PRELIMINARY SECTION

For easy reference we give hereafter a few abbreviations which will currently be used in the report.

TP	**Transparent paper** (Cellophane is a protected trade name)
PT	Plain Transparent paper
MST	Moisture proof, heat sealing TP
MSAT	Anchored, moisture proof, heat sealing TP

The report will cover in logical order:

- The viscose preparation
- The film production
- The coating of the film
- Handling and transport
- Testing methods and quality of final product

We wish to emphasize that this report gives its considerations and recommendations on the existing equipment. There would also be scope for recommendations to change and modernize certain equipment. However, those would involve substantial investment costs.

Remarks regarding modifications of equipment have therefore been made only in such cases where they can be executed by the plant's own workshop or at low cost by the local industry and for moderate machinery to be imported.

Further suggestions are made as guide lines for future expansions projects which are necessary to suit market requirements.

The discussions in the plant were held with the following gentlement

Mr. Mahmoud Ali	Chairman
Mr. Chafih Bahaa El Din	Plant Manager
Mr. Mahmoud Mokhtar	Production Manager
Dr. Ahmad Hafez	Chief Techn. Manager
Mr. Malek	Chief Engineer
Mr. Halim Nashed	Research & Development
Mr. Roushdi Kira	Assist. Mr. Mokhtar
Mr. Ahmed Morsi	Chief Coating Dept.
Mr. El-Sharbini	Engineer of Cellophane Dept.
Mr. Mokhtar El Teir	Chief Cellophane Prod.
Mr. Mahmoud Kamel	Chief Chem. Laboratory

[redacted]

III. DETAILED FINDINGS, DISCUSSIONS AND RECOMMENDATIONS

1. Viscose Preparation

As mentioned in the interim report the spinning viscose of MISRAYON prior to the first field period had the following compositions

Cellulose Content	8.9 - 9.1 %
NaOH Content	5.9 - 6.1 %
CS_2 on alpha-Cell.	28 %
Viscosity	32 - 36 sec. (20 cm,1/8")
Ripening Index (Salt point)	1.8 - 2.3 new machine
	1.2 - 1.8 old machine

The composition of viscose is normal although there is scope to make it still more economical, this especially as long as good quality pulp is available as raw material. CS_2-content is normal for a TP-Viscose.

As the viscosity was considered as low a raise to a level of 45-50 was suggested in the interim report. This suggestion was followed to a large extend and the level of viscosity is now 42-46 seconds. From statistical graphs it appeared that due to this the strength of the film had increased as it was to be expected, however, the elongation had a decreasing tendency.

As during the last two months the pulp in use was changed very frequently (31.8 -21.9 Sniace,
21.9 - 4.11 Uddeholm,
4.11-12.11 Billerud,
12.11 onwards Novacell K)

due to import difficulties it is extremely difficult to get a correct picture of any change in process conditions. Therefore the only positive conclusion is the increase of tenacity. The quality of pulp is of paramount importance on the quality of the end product. Furthermore, it takes days if not weeks to adopt optimum process conditions for each pulp.

[redacted]

No tests were made lowering the ripening index (salt point); this for the simple reason that with the present installation it is difficult to execute such a test. The salt point on the new high speed machine has an average 2,2 whereas on the old low speed machine it is about 1,5. If we lower the ripening index for the new machine it will automatically also be lowered on the old machine as the two systems are interconnected. Thus it will be too low on the old machine. Therefore before any further tests can be made in this direction the flow of viscose would have to be designed in such a way that for both machines the ripening index can be adjusted independently for best production conditions.

It can be stated that with the present ripening index of an average of 2,2 salt point the production is all right. We would suggest a lowering of ripening index only to avoid the danger of blushing of the film. There is always this danger when the viscose is too young.

As already stated in the interim report efforts should be made to keep the values of the analytical data in narrower limits both for viscose composition and all the other process characteristics. This is necessary to improve the regularity of quality of production.

Regarding the equipment for the preparation of viscose we wish to emphasize the following points which we already partially pointed out in the interim report.

1. At present after the deaerater a pump is transporting the viscose through blender, filtration and a very long pipeline to the viscose dosing pump before the casting machine. The pressure before this dosing pump is therefore varying. This may result in caliper variations of the film. It would be recommendable to install an overpressure valve with a return line before the dosing pump in order to assure a constant feed-pressure of viscose to the casting machine. This would also allow to save viscose during short stand stills of the casting machine as the viscose would automatically return to the pump after the deaerater and no bleeding would be necessary as it is done at present.

[redacted]

2. The mixing of viscose in the ripening room is too extensive. It is agreed that it is necessary to blend the various batches of viscose to equalize the composition but this mixing should not be too exaggerated to an extent where viscoses is of widely different ages are mixed together. Blending of viscose has to be done progressively.

3. For economical reasons it is suggested to shorten the time of ripening of viscose by raising the temperature in the cellar. It is understood that this is purely for economical reasons and it would not change the quality of the cellulose film.

4. As mentioned before it is suggested to synchronize the timing for both viscose lines so that for the old and the new machine individual ripening indexes for best spinning conditions can be adjusted.

[redacted]

B. The Casting Machines - TF production

The remarks hereafter are specifically made with reference to the latest new model of the two installed casting machines. General theoretical considerations will also apply to the old machine.

In the interim report it was stated that the spinbath with a concentration of 160 gr/lt sulphuric acid and a density of 1.290 at 40°C was considered as weak and a suggestion was made to decrease the density to about 1.250. In the between the two field periods the management of the plant decreased the density for a short while only to 1.230 and according to the explanation of the staff there was a tendency of flusting of the film an effect which theoretically is not understandable. However, in our opinion the trial was too short to be conclusive. During the second mission it was then decided to fix the density to 1.280 and at this density the machine was running smoothly.

It was also suggested in the interim report to use only one or two bleach bathes instead of three. All modern machines even running at high speed have only one bleach bath and to omit one or two of the present tanks at present in use at MISRAYON would be more economical. Furthermore it would avoid the danger of overbleaching and degradation thus reducing strength and elasticity of the film.

This suggestion also is interesting in connection with another problem: the limited desulfurizing. As MISRAYON has only one desulfurizing bath on its machine there is always a certain danger that some traces of sulphur are left in the film especially when running at high speed or with high gauges.

If one bleach bath is omitted the point can be studied to transform tank seven into a second desulfurizing bath. This would avoid the danger of sulfur traces in the film.

[redacted]

The suggestion to lower the temperature of the softening bath from 70 to approx. 45°C which was made in the interim report has been executed during the second field mission. As the test proved advantageous for the running of the plant this new temperature was adopted as normal process condition.

Anchoring was one of the main subjects of the expert's mission. Prior to the first field mission a test run was made with Nadavin FP as anchoring agent. However, the test was not satisfactory. A further test was made during the first field mission again for two days. During the machine presented no trouble and the achieved results were excellent especially with regard to heat sealing and bonding. In between two field missions and during the second mission no further tests were made due to the specific production program of the plant. However, the use of anchoring agent is now fully known to the plant's technical staff and a decision was taken during the second field mission that as soon as the production called for anchoring it will be incorporated in the normal production program.

As the interim report was not officially distributed to the plant some general considerations on anchoring are repeated.

The most common anchoring products are:
- ACCOBOND 3900 or 3906 (American Cyanamid)
- POLYMIN PR (BASF)
- NADAVIN FP (BAYER)

Accobond and Polymin are of similar composition and are both applied in a slightly acidic bath. Nadavin is used in an alcaline bath. Earlier Melamin resins were used but they needed tedious and complicated preparations.

Accobond is today considered as the most widely used of the three, especially when the film is to be coated with saran lacquer. It is available in liquid or powder form. Polymin and Nadavin are less used in the cellulosic film industry, however, are well known in the paper industry. In a separate annex we are enclosing pamphlets of the three products which are self-explanatory and give all information about their use.

[redacted]

The test in the plant was carried out with the following plasticizer bath composition:

917 parts Water

80 parts Glycerin

3 parts Nadavin FP

pH 7,5 (adjusted by Na_2CO_3 solution)

Temperature approx. 40 - 45°C

Heat sealing properties of the produced MSAT in comparison with MST increased approx. six fold. Blocking tests were satisfactory and it was seen that the anchoring film could be stored for several days without any danger of blocking until lacquering .

Normally a certain amount of anti-block agent is added to the anchoring bath. In the case of our plant trial with Nadavin this was not possible. Laboratory tests showed that the available anti-block agent Syntharesin K-30 is not compatible with Nadavin. As the actual production trials showed no blocking even after several days it appears that in case of Nadavin an anti-blocking agent can be omitted.

Accobond is preferably used in or before the plasticizer bath. For operational reasons it may simplify the production of various qualities if it is used independently in the bath preceding the plasticizer. Care has to be taken to keep the temperature of this bath at 40-45°C and the pH of 4,5 to 5,5.

It is very important that the anchoring bath is not contaminated by chlorine, chlorides and sulphates. It is also to be noted that only a fresh prepared anchoring bath has its full effect, therefore it is necessary to dose the Accobond solution continuously during production. If for one reason or other production is stopped and the bath content lies idle for a few days a new bath must be prepared. An Accobond bath should never be heated over 45°C as it looses its effectiveness, e.g. the reactions which should take place on the film take place in the bath.

[redacted]

For sake of information example of working with Accobond is given.

a) Preparation of the Mother solution

A mother solution is prepared by diluting 100 kg of Accobond in 900 lt of soft-water.

b) Preparation of the bath in the tank

Soft-water	1670 lt
Plasticizer	126 kg
Accobond (conz.)	21 kg
Aerosil DCF 784	5.5 lt
total	1800 lt

c) Dosing during production

1) Dose Plasticizer to keep concentration of 70 g/lt
2) Dose Accobond-mother solution in the ratio of 80 cc/min.
3) Dose Aerosil solution (1 lt in 9 lt soft-water) 40 cc/min.

C. COATING

1. Technology

Coating technology and lacquer composition is governed by the characteristics of the film quality to be produced. Hereafter we shall make our considerations on MAST as MST is no longer of great interest in the market.

If we consider the heat sealing values and blocking values obtained with MAST during the trial with NADAVIN we can state that the lacquer formula is principally correct.

Reservations have to be made regarding the analysis results for heat sealing available at the plant which are not comparable to standards.

As it was not possible during the second field period to make anchored productions due to organizational reasons of the plant several test were made in order to try to improve the heat sealing qualities of the film. We wish to state again, however, that the moment anchoring is anchored is adopted in the plant heat sealing of the film will be satisfactory. Therefore, these tests were only made as a temporary solution.

Two tests in this respect were made, one by raising the quantity of hard resins Ketaresin and Alresate from 0,825 to 1,5 kilo another one by raising the content of Palatinol from 4,5 to 8 kilo. Neither of the two tests gave any improvement of heat sealing. These tests demonstrated that in order to increase the heat-seal strength the best way is to adopt anchoring.

During the first field period the nitro-cellulose was from Messrs. WOLF WALSRODE type A600M. This is a well known nitro-cellulose and suitable for this type of coating. During the second field period another unknown nitro-cellulose was used. The same remarks made for pulp apply to certain degree also to nitro-cellulose.

Once a nitro-cellulose has been adopted changes should be avoided as each nitro-cellulose needs technological adjustments which are tedious and costly.

The suggestion to use a three componant solvent system has been followed and is adopted now in the production.

In the interim report it was suggested to adopt a more simple method for the preparation of lacquer. Between the two field periods tests were carried out at the plant. As these tests as well as laboratory tests were successful the new method has been adopted.

2. Equipment

As mentioned earlier we are commenting mainly the points which can be modified and improved with local means and/or low foreign currency needs.

Several suggestions were made in the interim report.

a) It was suggested to provide the lacquer storage tank's with a stirring device to avoid sedimentation of the antiblocking agent. The question had been studied by the plant management, however the time involved was too short to execute these suggestions. During the second field period the point was discussed in detail. For execution some parts of equipment would have to be imported.

b) It was suggested to simplify the lacquer circulation system which is actually complicated. Details of this suggestions which consists in lowering the complete circulation block with filters and heat exchanges and to provide the lacquer trough in the machine with an over-flow to a small intermediate tank connected to the circulation system were in detail discussed. It is up to the management of Misr Rayon whether or not to follow this proposal. This proposal was made purely to simplify operation of the machine and has no influence on the quality of the product.

[redacted]

c) It was furthermore suggested to replace the existing spreader rolls by similar to the ones existing in the humidification section of the casting machine. These rolls would have to be imported and therefore the realization of this suggestion depends whether it is possible to obtain the necessary import license.

d) During the second field period many trials were made in the rehumidification tower of the coating machine. The aim of these trials were first to eliminate the escaping of humid air on the top of the tower and second to have a more efficient rehumidification. The trials showed that the escaping of air on the top of the tower could not be stopped with the present design of the machine and a stoppage of this airloss could best be achieved by the installation of a air-lock; that is a small separate circulation system for air on top of the tower.

The inconvenience caused by this humid air for the workers could, however, be overcome by opening the door on the top floor. This method was tried and adopted as it improved working atmosphere and had no influence on the recovery yield of solvents.

With regard to the second point of these trials it appeared that the circulation could be adjusted more efficiently. The same degree of humidity in the film was obtained by lower air humidity in the circulating air.

e) The suggestion already made earlier to provide the absorbers of the recovery with snuff cocks should be followed as early as possible during the next maintenance period in order to check the recovery system better.

[redacted]

D. TRANSPORT

We already pointed out in the interim report that in any cellulose film plant utmost care must be taken in handling and transporting the reels. Care must also be taken that no dirt or condensate fall on the film. This point has to be given a lot of attention at MISRAYON. Improvements must be made in these respects.

Special wagons with supports for the reels could be made in local workshops. It should be borne in mind that piling the reels unsupported one on each other may cause blocking.

We can not stress enough the point that it is of no use to make a high quality film if afterwards the finished film on the reels is spoiled by small mechanical defects. Water droplets, damage by careless handling or inadequate transport may result in breakages in the subsequent operations These interruptions and breakages are a costly nuisance on any high speed packaging, slitting or printing machine as they cause waste and loss of time. Even if individual laboratory samples show excellent results, the film can only be classified as good if the whole roll runs through a machine without breakage. This point is actually given much more importance by the clients than individual laboratory test results.

E. TESTING AND QUALITY CONTROL

In order to determine the standard of production and which film characteristics have to be amended or improved it is of great importance to do regular checking according to the standard methods with appropriate instrumentation. In our opinion this point has to be given a lot of care at MISRATON.

Although there are no international standards several countries have published their own and these can be taken for comparison. In a separate annex we enclose a booklet "Cellulose Film Specification" which contains a collection of various standards and testing methods, and a booklet called "Analytical Methods in Viscose Industry". Both have been edited by the expert Mr. PUDL. We suggest that these annexes should be sent directly to the plant as they will help the technical staff to better judge their quality by standard testing methods.

With reference to the current analysis being at MISRATON the following comments are given:

Tenacity and Elasticity

MISRATON express their results for tenacity in pounds per sq.cm. The following table gives average values:

May-June	2,000 to 2,700 Longitudinal	1,400 to 1,700 traverse
August	2,600 Longitudinal	1,600 traverse
November	2,900 Longitudinal	1,800 traverse

In November the highest results were obtained with Bilterud pulp. All values are above European or Japanese standards. The European standards state a minimum of 1,400 lbs per sq.cm longitudinal and 700 lbs per sq.cm traverse. Japanese standards state for PT 300 1.2 kilos longitudinal resp. 1.2 kilos per strip of 15 mm traverse.

[redacted]

A sample was brought by the expert and analysed at MISRAYON's laboratory. This sample was from one of the major cellophane producers in Europe. The following values were found:

2,920 lbs per sq.cm longitudinal, 1,730 lbs per sq.cm traverse. Thus the november values were comparable to the ones of the European producer.

Elasticity values were during the month of May 13 to 18 % longitudinal and 35 to 50 % traverse. In November the average value were approximately 15 % longitudinal and 40 to 60 percent traverse. European standards ask for 12 % respective 25 % minimum values. Japanese for 10 % respective 20 % and American for 10 to 25 resp. 30 - 50 %. In general it can be said that the elasticity is also within the norms.

Burst - Strength

Average values for PT 300 are on the level of 1.6 to 1.7 kilo per sq.cm with occasional higher values. As 1.8 kilo/sq.cm is considered as minimum by European standard an increase of this strength should be achieved. This can be done by a further raise of viscosity. Furthermore careful attention has to be paid to the bleaching on the casting machine in order to avoid degradation of the film.

MISRAYON is calculating another factor in this connection. It is not an international standard value and we would suggest to abandon this test and with the time saved to determine the burst - strength regularly every day.

Transparency

This test has been done so far only by visual observations. The method of piling sheets on a white paper with black writing under a light source or daylight was shown to the laboratory staff. Although, this method is empiric it gives comparative results.

[redacted]

The following figures are considered as minimum standards.

PT 300	70 sheets	MSAT 300	60 sheets
PT 400	60 sheets	MSAT 400	50 sheets
PT 500	50 sheets	MSAT 500	40 sheets

Blocking

During the first field period and in the interim report it was suggested to adopt a more severe method for the blocking test. This due to the rel. hot climate in Egypt. The new test procedure was adopted by the laboratory and during a certain period both methods were done simultaneously. The records of the laboratory showed that of 34 samples according to the new method, five were not sufficient whereas according to the old method only one was not sufficient. This shows that the new method is more severe and for the benefit of a good quality control, we would suggest now to adopt definitely the new method and to omit the old one.

In general it can be said that the production of PT and MSAT is in order with regard to blocking. MST shows blocking which is another argument that anchoring should be adopted.

Heat sealing

As pointed out in the interim report and during the first field mission the heat sealing had so far not been done according to the standard methods. The obtained results were in our opinion not very reliable. Mr. FUEG introduced a standard method and this method had been executed in the meantime in the laboratory parallel to the old one. The statistics showed that the new method is more sensitive and we would suggest now to abandon the old method and to work only by the new method.

This would save time and this time should be used to make heat sealing tests daily. According to the new method values of 10 to 30 grams/cm was found with MST whereas with anchored film and the same lacquer composition 100 to 120 grams/cm were obtained. The later values are within the norms. American norms for instance stipulate 100 to 400 grams per 1½ inch.

The heat sealing apparatus in the laboratory is not adequate for proper testing. Neither temperature nor sealing time can be adjusted correctly. As the heatseal values are of importance to judge the quality of cellophane it is necessary that a correct laboratory heatsealer is available at the plant. In this connection it can be mentioned that a French sample was tested and also this sample gave only 24 grams/cm. The expert has taken a sample from the MISRAYON's MST production to Europe and it was tested in a specialized laboratory. The results obtained were lower than at MISRAYON's laboratory, 8 - 10 gr/cm.

Permeability

This test has also not been done according to standard procedures and at mild testing conditions that is at 20°C and 60 % relative humidity. It is suggested to adopt the standard method and perform the test with 90 % rel. humidity at 20°C or for some tests at 38°C.

The necessary equipment for standard testing is not available at present at MISRAYON and should be purchased.

From records it appears that this test is only done at irregular intervals. To follow the production also this test has to be done daily.

As international specifications give their norm values for 20°C or 38°C and 90 % rel. humidity it is difficult to make a comparison with the actual figures found at MISRAYON. However, a foreign sample was analysed in the laboratory and a value of 6.6 gr/m^2/24 hr. was found. The current results of the plant were in August 5-10 gr/m^2/24 hr.

Thickness regularity (Diagram)

Testing of the diagram has to be done more frequently. Hand testing e.g. cutting squares every 10 cm of the width and weighing should be done from every or at least every alternative roll in order to correct immediately thickness variations. The electromicrograph which is not in working condition at present due to lack of spares should be repaired as quickly as possible. Caliper measurements are important for quality control.

Humidity and Plasticizer Content

Both values should be more regular. Supervision of the drying conditions and the plasticizer bath has to be done more careful in order to have more uniform results. Furthermore, the humidity of the lacquered film should also be determined regularly and not only exceptionally.

Sulphur Determination

Sulphur in the film is at present determined approximately twice a week. This analysis is done in the main laboratory by a time consuming method. Laboratory analysis showed that the results have to be considered with certain reservations as the inherent error of the method is considerable.

It would be advisable to adopt a simpler method which can be done in the production department at short intervals. This simple method was shown to the laboratory staff. It is more important to know at any moment whether the film is enough desulphurised than to make a time consuming analysis only every two or three days. If the film is not desulphurised sufficiently for a few hours of production it will only be found out after a few days when the film starts to smell. Insufficient desulfuration has to be discovered immediately by analysis otherwise production has to be declassified.

[redacted]

IV. SUMMARY OF RECOMMENDATIONS

a) Advise on the steps necessary to bring existing production of cellophane film up to a standard competitive with good quality European film.

Besides the remarks made earlier in this report we wish to stress once more the point that a good cellulosic film is first of all characterized by its consistent quality. To achieve this it is necessary that the plant has a regular supply of raw materials fulfilling the required specifications. Furthermore, there should be sufficient spares on hand (casting heads, rolls, etc.) and stand-by equipment installed to assure virtually uninterrupted production. After any shut-down, considerable time is needed for process adjustment.

Unfortunately, due to causes beyond the plant management's control (import difficulties) the above requirements cannot be completely met. Supply of certain spares and stand-by equipment, and modification of the viscose pipelines leading to the casting head would help considerably to overcome these difficulties. Summarizing the comments on the various analytical data of the film it can be said with the exception of heat sealing the majority fall within the norms. Suggestions for improvements have been discussed and proved out in trial runs (anchoring).

Occasional blocking and residual sulphur must be avoided through closer production supervision. Again, we wish to stress the point that much more attention should be paid to handling and transport in order to avoid damaging the film after its manufacture.

b) Advise on incorporation of anchoring.

A successful trial run was made in the plant, the various anchoring agents were discussed and respective literature was handed over.

The executed tests had shown that anchoring should be introduced and become part of standard production at MISRATOX in order to improve quality.

[redacted]

3. Various points in the Copple report are confirmed herewith:
the complicated lacquer preparation procedure (now modified during the field period); the advantage of ball milling the antiblocking agent (equipment missing); solvent leaks; lacquer level in lacquer trough. Other suggested improvements have been carried out in the meantime such as the replacement of benzene by toluene and the use of better quality nitrocellulose. We do not, however, agree with the statement that air nozzles are not necessary in the drying tower. The better the arrangement of air distribution and circulation, the better is the film guided in the towers. If the air circulation system is designed correctly, there is no need for auxiliary guide rolls inside the towers as presently installed at MISRAYON. It is evident that the nozzles should not protrude into the tower as they do presently; rather they should be flush with the wall. There is always the possibility that the film can be caught and torn by the nozzles and that lacquer be deposited on them, which requires frequent cleaning.

d) Detailed formulae and technology ....

i) For manufacturing of moisture-proof, heat sealing, anchored transparent paper on casting machines and

ii) For viscose manufacture solutions

i) May we first point out that the moisture-proof and heat-sealing properties are given to the film by the lacquer coat and not by the casting machine. MISRAYON has an average lacquer formula which should only be changed if any specific quality of the film is not satisfactory. The enclosed brochure, Surface coating of Cellulose Film, describes the function of the various additives to the lacquer. Knowing the properties of each component, it is easy to make a change in the lacquer formula if it is desired. There is no universal standard formula for lacquer as it depends on

- climatic conditions
- customer's preference
- available raw materials

Detailed remarks on MISRAYON formulae have been made in Chapter III C. Anchoring has also been fully discussed.

[redacted]

c) Supervise and advise on the coating with nitrocellulose materials. ....

Process and technical suggestions have been indicated in detail in Chapter III C. In addition to these we give the following comments taking into account the earlier report of Arthur Coppie Ltd.

1. The present capacity of the coating plant is limited by the exhaust air fan leading to the recovery. If an increase of production capacity is desired, fans with higher capacity would have to be installed. Furthermore, the solvent-air flow system between drying tower and absorbers is too complex, and, as various trials showed the air coolers have a high resistance. It is suspected that the air coolers are partially blocked by dried lacquer and film particles. The decision whether new coolers and/or fans should be installed can only be made after a thorough cleaning of the whole system.
In any case, even after modification of the above-mentioned air flow system, speeds of more than 100 m/min are hardly possible on the present machine. For higher speeds, the complete duct-work and air distribution system in the towers would have to be changed.

2. Theoretically the present coating and reconditioning towers could be used for saran coating, however, only at low speeds of approximately 40 - 50 m/min. Separate lacquer preparation and pipelines up to the machines and new recovery and storage tanks for THF and THF/Toluene mixture would furthermore be necessary (as already stated in Coppie's report).

All these changes would be very costly and cause interruption of production for weeks, if not months and would give only unsatisfactory results.

Therefore, the only economical solution for production increase and for making saran coating would be the installation of a complete new unit designed to run nitrocellulose lacquer up to 250 m/min and saran lacquer up to 140 m/min. Cost of such a unit would amount to approximately 2 million Swiss francs.

[redacted]

ii) Viscose preparation has been discussed in detail in Chapter III A. We may add here that modern plants prepare an even more economical viscose with, e.g. up to 9,4 % cellulose and 5,6 % NaOH and viscosities 70-100 sec. However, such viscose needs more sophisticated viscose preparation equipment than is actually installed at MISHAVON. Therefore we advise keeping the present composition and only to gradually increase the viscosity to 30 sec. and lower the salt point to 1,8 - 2 for the new machine.

e) **Transport**

Attention must be given to transport and handling problems of the finished reels. Staff and workers must be instructed to handle the reels very carefully to avoid any damage. PT rolls should be sealed so that the outside layers do not absorb humidity and become wrinkled.

[redacted]

5. SPECIAL REMARKS

5.1 Suggestion to Misrayon to become a member of CIPCEL

In the interim report we mentioned that there might be a possibility that MISRAYON could become a member of the International Manufacturers Organization of Cellulosic Film called CIPCEL, 35 rue de la Boétie, Paris 8, France. In the meantime we have contacted the secretary of this organization and he informed us that there is in principle no objection that MISRAYON would join this organization. This would help MISRAYON to exchange news with other cellulosic film manufacturers and always be informed about new quality standards.

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b) Suggestion to Misrayon to purchase testing equipment

It is very important that MISRAYON has full knowledge of the quality of their own production. For this the analysis methods have to be adopted to international standards and partially new analysis equipment to be bought. Furthermore, the analysis have to be done more regularly according to specified schedules.

Our expert has been given to understand that there is a possibility to buy the most urgently needed testing equipment on short notice if funds could be made available through UNIDO at Cairo. If such possibility exists we would recommend the purchase of the following testing equipment.

a) Heat-seal-tester Model CHeII with adjustable temperature and time	Sfr.	2,000 approx.
b) Water vapour transmission testing apparatus according to DIN 53122	Sfr.	4,000 approx.
c) Lacquer viscosity meter	Sfr.	100 approx.
d) Spare parts for the existing Electro micrograph (which is not in operation due to lack of spares)	Sfr.	1,000 approx.
	Total Sfr.	7,100
Airfreight to Cairo	Sfr.	1,000 approx.
Contingencies	Sfr.	1,900
Total funds	Sfr.	10,000 approx.

We are in contact with the various suppliers of this equipment. For speedier delivery and organization all items could be ordered through MAURER.

Berne, 8th February, 1972

W.O. Pfleg

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APPENDIX

SURFACE COATING OF CELLULOSEFILM

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SURFACE COATING OF CELLULOSE FILM

1. Introduction

Coating of plain cellulose film with surface coating lacquers is done with the aim to give to the plain cellulose film two properties which it does not have when not coated.

1. MOISTUREPROOFNESS
2. HEAT SEALING

Both are extremly important for today's packing industries. Materials which are packed in uncoated cellulose films will absorb humidity from the prevailing atmosphere and in certain cases e.g. food, pharmaceutical products be spoiled.

Heat sealing is necessary for all cellulose films which are used in modern automatic packaging machines, e.g. cigarette packing. The degree of moistureproofness and/or heat sealing can be varied according to the composition of the lacquer used. For each field of application the best and optimum lacquer composition has to be found out by research work and then applied. The climatic conditions in the country where the lacquered cellulose film is used are also important for the lacquer composition to be chosen.

2. The lacquer composition

The lacquer which is applied on cellulose film consists generally of five main items which are:

a) nitro cellulose
b) resins
c) plasticizers
d) waxes
e) antiblocking agents

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Nitro cellulose

As nitro cellulose normally a low nitrogen and medium to low type viscosity quality is used for a all purpose lacquer. Such types are:

Hercules SS½ second
WASAG A5
Hagedorn A H 22

Nitro celluloses normally contain a damping agent either dibuthylphtalate or isopropanol which is used to avoid the risk of explosion during transport. Nitro cellulose is the actual lacquer carrier of the coating.

Resins

Various resins are used and added to the lacquer formula as e.g. Petrex, Vinapas, Becasite, Estergum etc. The resins have in principal three functions:

a) to give a good adhesion between lacquer and cellulose film,

b) to give a sufficient compatibility between nitro cellulose and paraffin wax,

c) to give the optimum heat sealing property to the lacquer.

Plasticizers

The selection of plasticizers in a surface coating lacquer has to be made by taking into consideration the following facts. The plasticizers are important to give and improve the heat sealing properties, however, a too big percentage will increase the danger of blocking the film. On the other side, if not enough plasticizers are added to the lacquer the film might not be enough elastic and be brittle.

The amount and kind of plasticizers to be added depend to a great extent on the end use of the cellulose film in the packing industry. A film which is used for cigarette packing has to have less plasticizers as it has to be stiffer than a film which is e.g. to be used for candy wrapping by hand. A great variety of plasticizers are in use: the most common ones are dibuthyiphtalate, sextolphtalate and dicyclohexylphtalate.

Paraffin wax

The purpose of paraffin wax in a surface coating lacquer is to give the moisture vapour barrier and also to assist in improving the antiblocking properties of the coating. Here again, various waxes with different melting points can be used, depending on the final use of the cellulose film.

Antiblocking agents

The antiblocking agents added to the surface coating lacquer can be e.g. SiO_2, stearates etc. Their presence avoids the later blocking of the final cellulose film.

Solvents

Surface coating lacquers normally are prepared in solvent mixtures of two or three different solvents. The most common are ethylacetate, buthylacetate and toluene. The solvents are recovered and reused in normal coating operations.

3. Preparation of surface coating lacquer

First the mixture of solvents is prepared in the lacquer preparation tank and its temperature adjusted to 35 - 45°C. Thereafter the necessary

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amount of nitro cellulose is added and kept under stirring until it is completely dissolved. After the nitro cellulose has been completely dissolved, the other chemicals, resins, plasticizers and at the end paraffin are added to the lacquer in their desired amounts. At the end the antiblocking agent is added.

Normally this agent should, before being added to the lacquer composition, first be predispersed in a certain amount of plasticizer in a ball mill in order to enable a better dispersion in the lacquer. Stirring is continued until complete dissolving of all the ingredients and during this operation the temperature is maintained after which the lacquer is passed through a filter to the resp. storage tanks. From the storage tanks in which the lacquer is kept at the specific desired temperatures, the lacquer flows to a small dosing and circulation tank which feeds it to the lacquering machine. From this dosing tank the lacquer is in constant circulation with the lacquering machine.

The temperature is kept at a constant preset level in order to keep the viscosity of the lacquer constant and by this achieving a uniform coating on the cellulose film. It is important that this temperature is kept constant for the above mentioned reason and the lacquer is kept in constant circulation in order to avoid sedimentation of the antiblocking agent. It is also important to be noted that a once prepared lacquer should be used and consumed as soon as possible and not to be stored a too long time; this also to avoid sedimentation of antiblocking agents.

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