

**CONFIDENTIAL - FILE NOTE**  
**LABORATORY CIRCULATION ONLY**

FILE NOTE NO. 0651

17th November, 1965

FILTER ROD MANUFACTURE 1st APRIL - 1st NOVEMBER, 19651. Assessment of P.T.C. Machine

Work has been completed on the assessment and is being reported fully by D.E.C.

2. Poly(ethyleneimine) on Cellulose Acetate Filter Rods

Application of the poly(ethyleneimine) or P.E.I. is by two spray guns situated between the metering rollers and the entrance into the garniture. The P.E.I. was supplied as a fifty percent aqueous solution. The water tends to separate out from the polymer on standing, giving uneven distribution in the container and an accurate method of dilution was evolved in order to overcome this separation. This was based on measuring the viscosity of the solution, and by using a simple calibration the concentration was determined with reasonable accuracy. The maximum viscosity sprayable was found to be 1,000 centipoises, which corresponds to a 30% aqueous solution. The viscosities were measured using a Brookfield Viscometer.

A Slack and Parr stainless steel pump was used to pump the P.E.I. to the spray guns. It was connected to the Threaded Roll Machine via a P.I.V. gear box, thus allowing alterations in the loading of P.E.I. on the cellulose acetate tow. Stainless steel fittings were used throughout as brass or copper will react chemically with P.E.I.

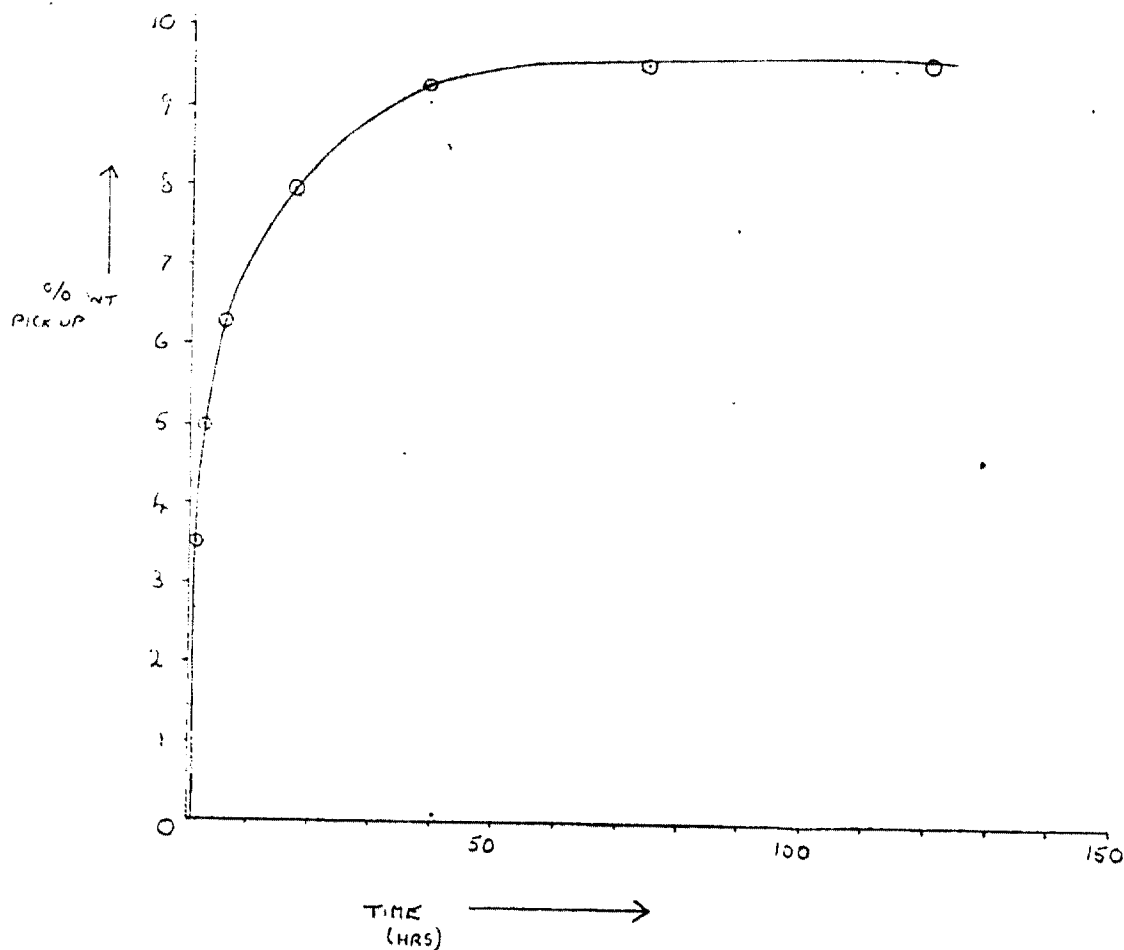
The paper used to wrap the acetate tow was varied. The wet P.E.I. tends to seep through normal filter plug wrap giving discolouration. To overcome this, a polythene lined paper was originally used. Unfortunately on drying the rod, the acetate tow shrunk inside the paper tube, giving recessed ends. The problem was overcome by reverting to a normal but thicker wrapping material

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(45 g/m<sup>2</sup>), and using glue lines to stick the tow to the paper. Some discolouration of the paper still occurs.

After manufacturing, the filter rods are dried in a Hauni Tray Drying Plant at 40°C. Complete drying required about 2½ hours, depending on the loading. P.E.I. is hygroscopic, so that the rods will pick up water unless stored in a dry atmosphere. The rate of water pick up for a rod containing 10% P.E.I. is shown in Graph 1. (This was later shown to consist of 7 parts water and 2 parts carbonate.)

GRAPH 1



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All rods were manufactured at a size of 84 mm x 24.2 mm. They are thus immediately available for use on the P.T.C. machine should it be required.

Filter rods from each experimental run were sent for analysis. The P.E.I. was estimated by finding the percentage nitrogen in the rod and multiplying by approximately 3.

Where triacetin and polyethylene glycol are loaded in conjunction with P.E.I. their estimation is not possible due to reaction with the P.E.I.

Equipment in Use For P.E.I. Spraying

1. Spray Guns

2 Aerograph De Vilbiss Guns Type GFG

Using Air Cap No. 58 and Fluid Tip No. EX

2. Delivery Pump

1 Slack and Parr stainless steel pump delivery 5 cc/rev

3. Dryer

1 Hauni Tray Drying Plant Model KMGS No. 85

3. Rods Manufactured

Attempts to load filter rods at a required level were not always successful first time. Thus many rods, though having an F number are of no use except for the experience gained in using a new additive.

The following list does not include such experimental rods.

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(a) Bondex Rods

F No.	Length (mm)	Circ (mm)	Granules	Bonding Agent/ Loading	Purpose	Comments
242	78	24.9	207C Carbon (18-44)	25% Trisodium Phosphate	Lab. 18	-
243	78	24.9	207C Carbon (18-44)	33% Trisodium Phosphate	Lab. 18	-
263	78	24.9	207C/Vermiculite 4:1 Ratio	20% Telcothene Powder	Lab. 18	-
264	78	24.9	Vermiculite	33% Telcothene Powder	CONQUEROR	Poor Bonding
265	78	24.9	Mol. Sieve 13X	20% Telcothene Powder	CONQUEROR	-
266	78	24.9	Sepiolite	20% Telcothene Powder	CONQUEROR	-
324	78	24.9	Silica Gel	20% Telcothene Powder	CONQUEROR	Extra heat required

(b) Paper Rods

F No.	Length (mm)	Circ (mm)	ΔP (cm)	Additive	%	Anal. of Figure	Comments
253	90	24.9	-	Potassium Dimethyl Glycinate	20		Uneven loading
340	90	24.9	17.20	Potassium Zincate	20	By Zn est = 1.1 By K est = 11.2	
363	90	24.9	2.7-15.2	Potassium Zincate	40	-	No crimping due to excess loading ∴ ΔP poor

The potassium zincate was ordered from B.D.H. as a 20% solution. Analytical figures showed an excess of caustic potash in the solution. The final figures thus show a total solids loading of 11% for F340 but a potassium zincate level (calculated on percentage zinc) of only 1.1%.

100056787

On attempting to manufacture F363 with double the amount of zincate, very poor crimping resulted. This caused the pressure drop to vary immensely, due to channels of air forming in the filter rod.

(c) Acetate Rods

F No.	Tow	Length (mm)	Circ (mm)	ΔP	% Triacetin	No. Made (Trays)	Additive	% Additive	Analytical		Purpose and Comments
									% T.A.	% Additive	
244	5/68	90	24.9	28	-	$\frac{1}{2}$	PEG 400	5	-	6	CONQUEROF
245	5/68	90	24.9	28	-	$\frac{1}{2}$	PEG 400	10	-	9.3	
246	5/68	90	24.9	28	-	$\frac{1}{2}$	PEG 400	15	-	12.6	
247	5/68	90	24.9		-	$\frac{1}{2}$	Tween	15	-	14.6	
252	8/43	90	24.9	-	6	15	-	-	-	-	
254	8/48	90	24.8	-	6	13	-	-	-	-	
255	8/48	90	24.4	-	6	4	-	-	-	-	
256	8/48	90	25.0	-	6	4	-	-	-	-	
267-294 Experimental runs including P.E.I. Runs											
295	5/68	60	24.2	-	-	$\frac{1}{2}$	P.E.I.	10	Figures Inconclusive		Lab. 18
296	5/68	60	24.2	-	6	$\frac{1}{2}$	P.E.I.	10	Due to		Lab. 18
297	5/68	60	24.2	-	-	$\frac{1}{2}$	P.E.I. PEG 600	10 6	Reaction of Components		Lab. 18
299	5/68	90	24.8	-	-		Ethomeen	15	-	16	CONQUEROF
313	5/72	60	24.2	-	-	4	P.E.I.	10	Figures Inconclusive		Lab. 18
314	5/72	60	24.2	-	6	4	P.E.I.	10	Due to		Lab. 18
315	5/72	60	24.2	-	-	3	P.E.I. PEG 600	10 6	Reaction of Components		Lab. 18
319	5/72	60	24.2	-	-	20 Rods	P.E.I. 207C Carbon	10	-	-	Made by Hand for Lab. 18

100056788

F No.	Tow	Length (mm)	Circ (mm)	AP	% Triacetin	No. Made (Trays)	Additive	% Additive	Analytical		Purpos and Commen
									% T.A.	% Additive	
320	5/72	60	24.2	-	-	$\frac{1}{4}$	Polymin F.L.	10	-	10.3	Experi mental
321	5/72	96	24.2	-	6	10	-	-	-	-	P.T.C. machin
322	5/72	84	24.2	-	6	10	P.E.I.	10	-	-	P.T.C. machin
325	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	15.4	Experi mental
326	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	14.7	"
327	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	12.0	"
328	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	10.8	"
329	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	18.0	"
330	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	17.2	Poor distrib ution
331	5/72	84	24.2	-	6	4	-	-	-	-	P.T.C. Machin.
332	5/72	96	24.2	-	6	4	-	-	-	-	P.T.C. Machin.
333	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	21.5	Experi- mental
334	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	19.7	"
335	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	17.8	"
336	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	15.0	"
337	3/48	84	24.1	-	-	$\frac{1}{2}$	P.E.I.	-	-	14.1	"
338	3/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	16.8	"
339	3/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	19.0	"
341	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	10.5	"
342	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	14.7	"
343	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	12.0	"
344	5/72	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	10.7	"
345	2.1/57	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	11.7	"

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F No.	Tow	Length (mm)	Circ (mm)	$\Delta P$	% Triacetin	No. Made (Trays)	Additive	% Additive	Analytical		Purpose and Comment:
									% T.A.	% Additive	
346	2.1/57	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	13.6	Experi- mental
347	2.1/57	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	15.3	"
348	2.1/57	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	15.9	"
349	5/72	84	24.2	35.2	-	1	Triton X100	17	-	16.7	CONQUER
350	3/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	8.1	Experi- mental
351	3/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	13.6	"
352	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	12.4	"
353	8/48	84	24.2	-	-	$\frac{1}{2}$	P.E.I.	-	-	10.0	"
354	3/48	84	24.2	-	6	5	P.E.I.	10	-	-	P.T.C. machine
355	8/48	84	24.2	-	6	5	-	-	-	-	P.T.C. machine
356	2.1/57	84	24.8	-	6	30	-	-	-	-	Packag machine
357	8/48	84	24.2	-	6	5	-	-	-	-	P.T.C. machine
358	3/48	84	24.2	-	6	4	P.E.I.	10	-	-	P.T.C. machine
359	5/72	84	24.2	33-9	-	$\frac{1}{2}$	Reoplex 100	15	-	16.4	CONQUER
361	8/48	90	24.75	-	6	10	-	-	-	-	
364	5/72	84	24.2	39.4	-	$\frac{1}{2}$	Span 20	15	-	17.0	CONQUER

It will be noticed that many pressure drops are omitted. This is because Quality Control have not been able to measure pressure drops accurately on rods with a small circumference such as 24.2 mm. Also, due to a faulty pressure drop apparatus, certain results have been invalidated.

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