International Journal of Multidisciplinary Research Education Analysis and Development – IJMREAD

Peer-Reviewed : Open Access Journal

Effect of Storage Time Over FM and Izod Property of PP Resins

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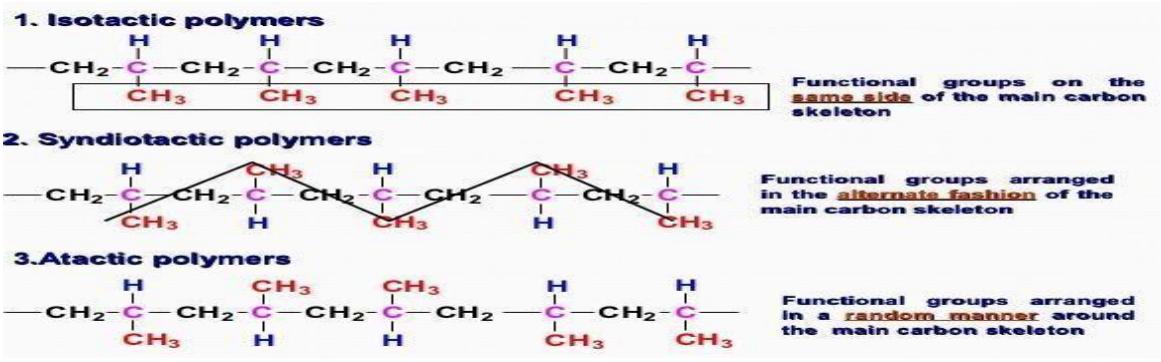
Abstract

Flexural modulus and Izod are the critical properties of Co-poly propylene material which depends on the amount ethylene content, which is present in the structure. The flexural modulus is the capacity of a polymer/plastic material to bear the load without undergoing any deformation i.e. bending and breaking at specified conditions. It is an intensive property it can be altered by various modifications during the polymer preparation and pelletization in an extruder. It is a measure of the stiffness or resistance to deformation of a material. The another excellent property to measure the toughness of polypropylene material is Izod test, during the Izod test the loss in kinetic energy can be measured using a cantilever, which has been allowed to fall on a notched polypropylene specimen. Impact strength is computed by dividing impact energy in J by the thickness of the specimen. It is measure of toughness, ability of a material to resist breaking when force is applied

Keywords- Izod, Syndiotactic, flexural, cantilever, intensive etc.

Introduction-

A chemical reaction in which small molecules join together to form very large molecules are called polymers and this process is called polymerization. Polypropylene materials are one of the best materials among different materials due to its excellent properties like low density, high melting temperature, high chemical resistance, easy manufacturing cost and long durability. The polymers are prepared using variety of monomer as homo polymer and co-polymer, among different monomer propylene is an



Xylene solubility mainly depends on amorphous content level and it is directly related with amount of block copolymer/or rubber content present in the matrix. The block Co-polymer has 3-15 % ethylene content; if ethylene content in the polymer matrix gets increases the xylene solubility and flexural modulus value found less, whereas impact strength of block copolymer found to be increased.

Principle-

Flexural modulus is the ratio of stress to strain during a flexural deformation or bending. A test specimen is prepared as per ASTM D 790 conditioned at Temp 23 $\pm 2^{O}$C & RH 50 ±10% for 40 hr. After conditioning, test specimen of rectangular cross section rests on two supports in a flat-wise position and loaded at the midpoint, the maximum stress in the outer surface of the test specimen occurs at the midpoint.

Flexural Stress (σ_f):

$$\sigma_f = 3PL/2bd^2$$

Where:

σ = stress in the outer fibers at middle point, MPa

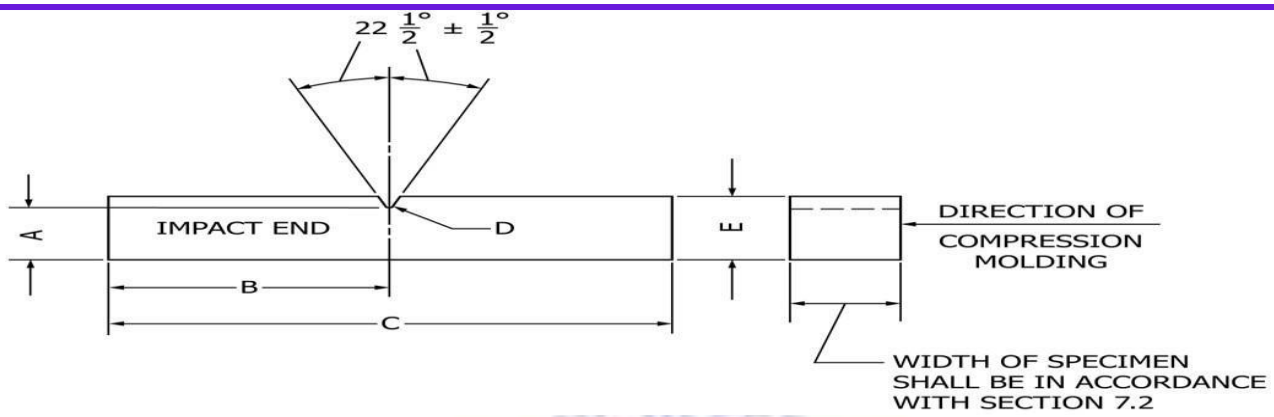
P = load at a given point on the LD curve, N

L = support span, mm

b = width of beam tested, mm

d = depth of beam tested, mm

Impact strength (J/m) is calculated by dividing impact energy (J) by the thickness of the specimen (m). The Izod specimen is prepared & notched as per ASTM D256



	mm
A	10.16 ± 0.05
B	31.8 ± 1.0
C	63.5 ± 2.0
D	0.25R ± 0.05
E	12.70 ± 0.20

Specimen conditioned at **Temp 23 ±2^{O}C & RH 50 ±10%** for 40 hr. After conditioning of the specimen, it has been clamped vertically at one end as a cantilever beam. A pendulum hammer is allowed to fall from a preset height, striking the specimen of given dimensions at a fixed distance from the specimen clamp. The specimen is broken by a full single swing of the pendulum and the amount of energy absorbed by the specimen is measured.

Izod impact resistance = Energy absorbed by specimen/width of the specimen under the notch.

Instrument used:

- **Injection Moulding Machine**
- **Micrometer**
- **Vernier Calipers**
- **Universal Testing Machine**
- **Izod impact tester**
- **Notch Cutter Machine**
- **Conditioning chamber (Temp 23 ±2^{O}C & RH 50 ±10%)**

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Experiment Work:

During the molding of specimen from PP resin the morphology of the PP resin changes and it affects the physical property of the Polymer. In the present work a study has been carried out to evaluate the effect of storage time over the physical properties (FM and Izod) of PP resin.

To study the effect of storage time FM & Izod of PP (ICP grades) analysed at different time intervals:

I. Spot Sample (Specimen without conditioning)
II. Silo Sample (After 8-12 hour of production)
III. PPMC samples (Received after one or two days after receiving of Silo Sample)
IV. PPMC samples after seven days from receiving
V. PPMC samples after fifteen days from receiving

Test Results:

Test Results of FM (Mpa)							
Sr. No.	**Grade**	**Spot Sample (Specimen without conditioning)**	**Silo Sample (After 8-12 hour of production)**	**Difference Between Spot & Silo Test results (%)**	**PPMC samples (Received after one or two days after receiving of Silo Sample)**	**PPMC samples after seven days from receiving**	**PPMC samples after fifteen days from receiving**
1	**3030MG**	822	1020	24.1	1010	1028	1030
2		812	1024	26.1	1009	1022	1032
3		853	1008	18.2	1036	1062	1080
4		888	1042	17.3	1048	1074	1076
5		866	1050	21.2	1070	1074	1076
6		846	1044	23.4	1064	1066	1074
7	**4080MA**	862	1080	25.3	1090	1095	1110
8		886	1134	28.0	1122	1130	1132

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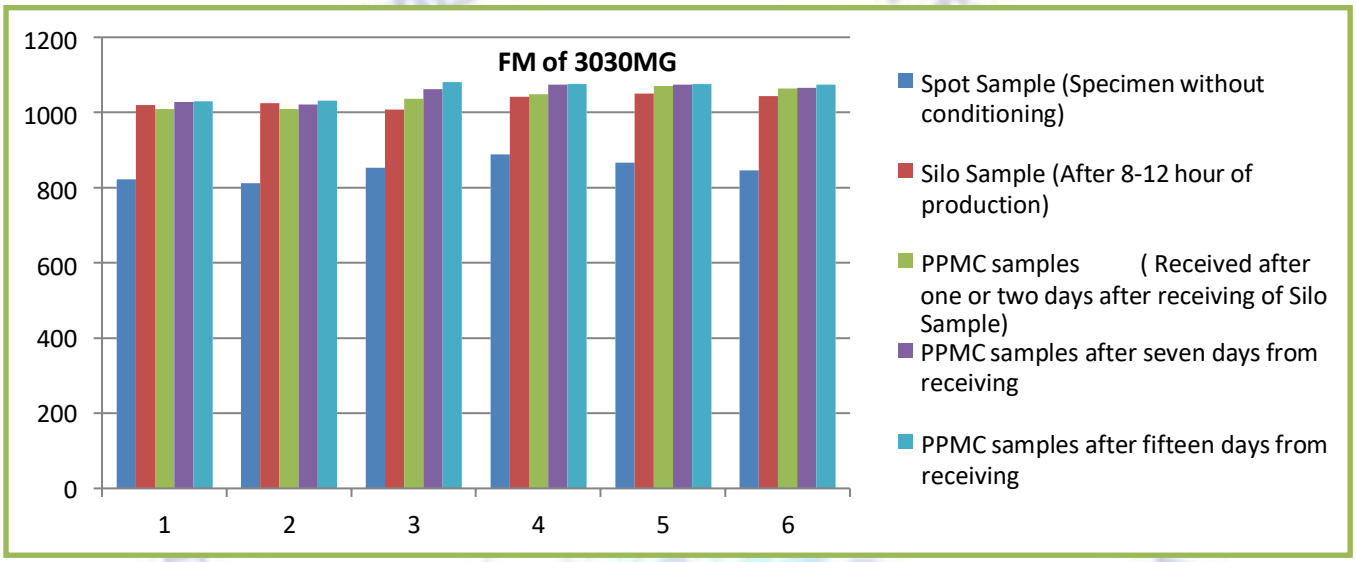
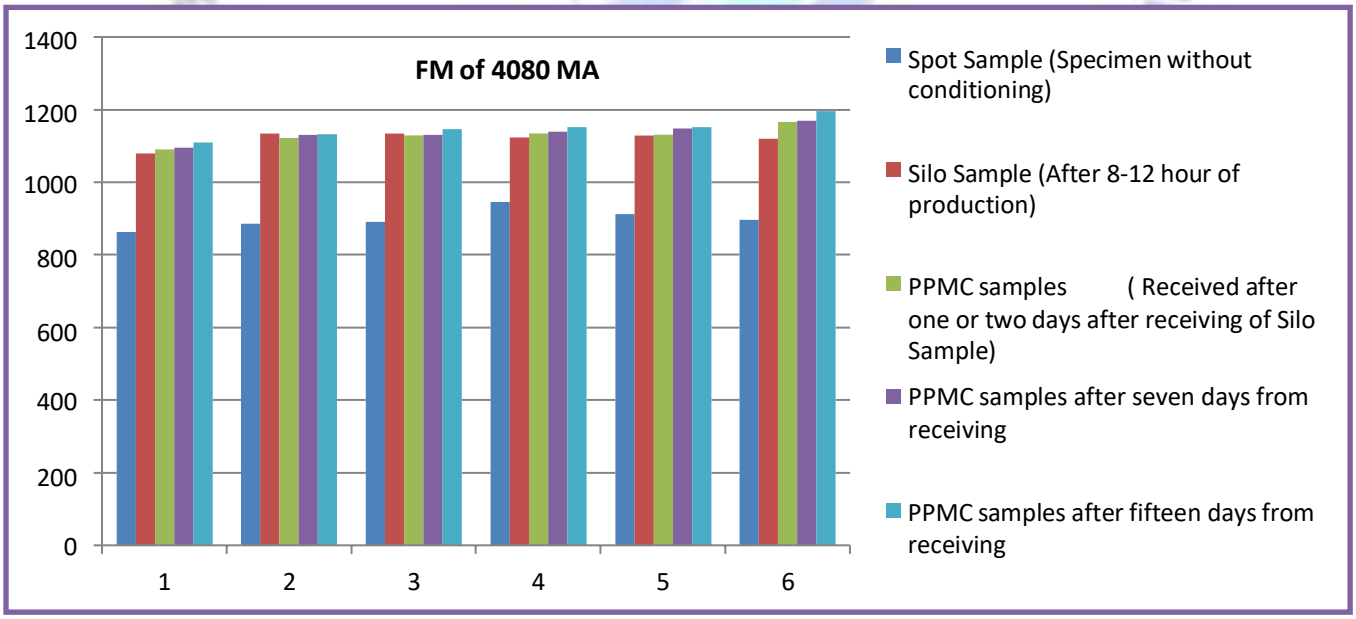
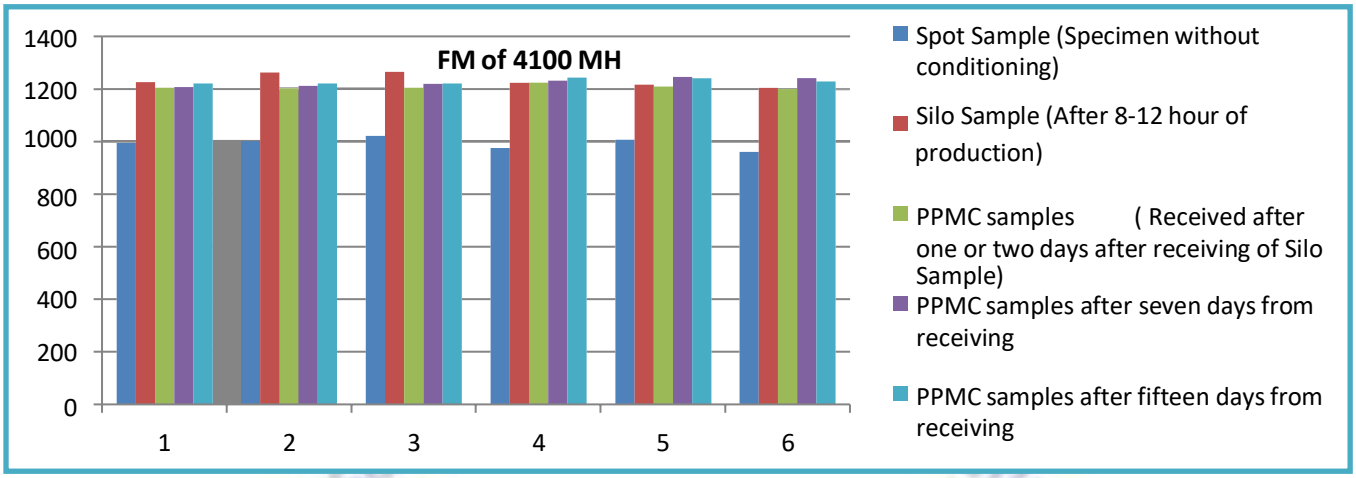
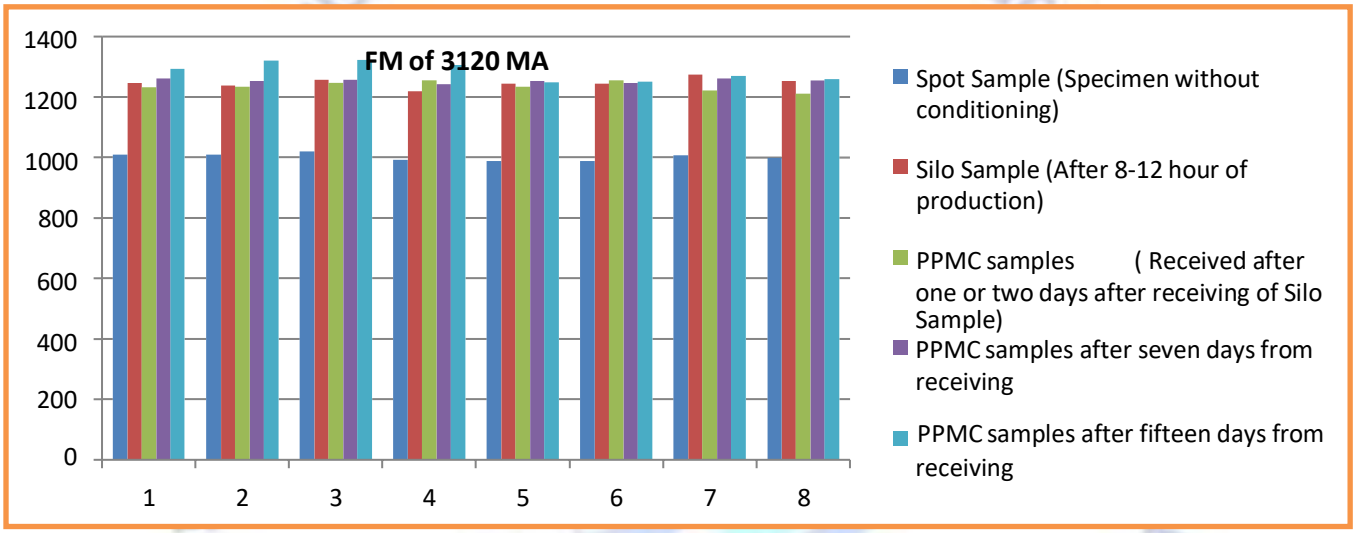
9		890	1134	27.4	1128	1130	1146
10		946	1124	18.8	1134	1140	1152
11		912	1128	23.7	1130	1148	1152
12		896	1120	25.0	1166	1170	1196
13	**4100MH**	995	1226	23.2	1204	1206	1222
14		1003	1262	25.8	1202	1212	1222
15		1022	1266	23.9	1205	1218	1220
16		976	1224	25.4	1224	1232	1242
17		1006	1216	20.9	1210	1246	1240
18		960	1204	25.4	1200	1240	1228
19	**3120MA**	1010	1246	23.4	1232	1262	1294
20		1010	1238	22.6	1234	1252	1320
21		1020	1258	23.3	1246	1258	1322
22		992	1218	22.8	1256	1242	1306
23		988	1244	25.9	1234	1252	1248
24		989	1244	25.8	1256	1246	1250
25		1007	1274	26.5	1222	1262	1270
26		998	1252	25.5	1210	1256	1260
27	**3400MN**	938	1142	21.7	1154	1158	1152
28		945	1142	20.8	1154	1134	1166
29		935	1112	18.9	1138	1136	1186

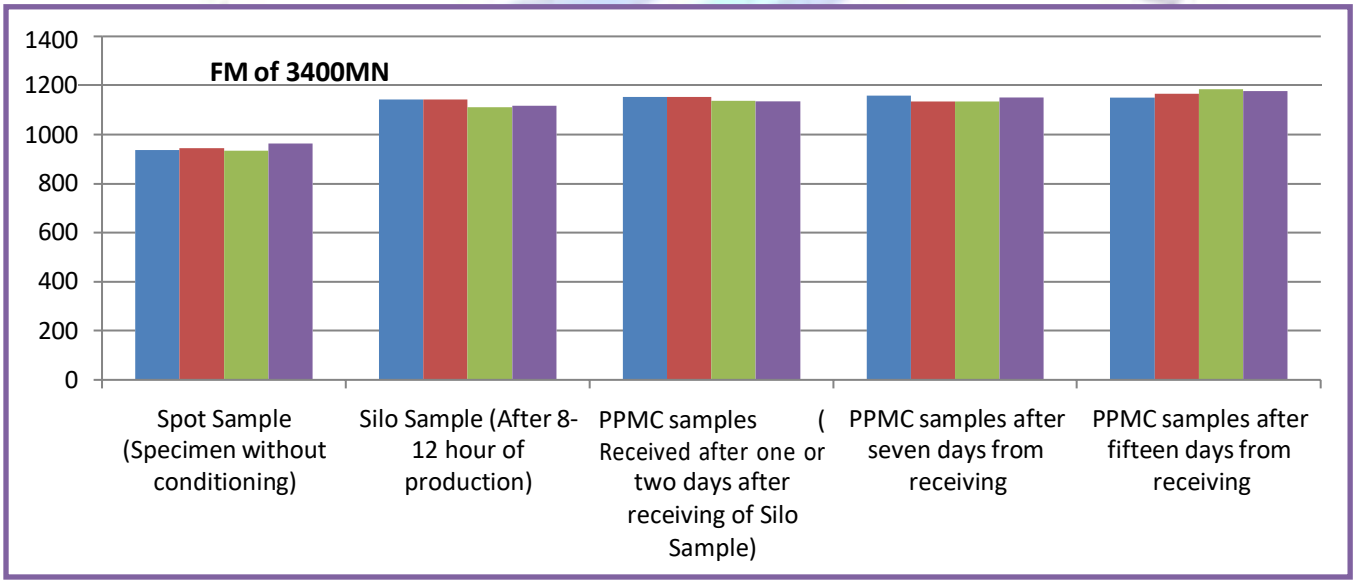
30		963	1118	16.1	1134	1152	1176
31	**3650MN**	964	1202	24.7	1205	1212	1208
32		989	1210	22.3	1212	1214	1222
33		962	1200	24.7	1201	1202	1236

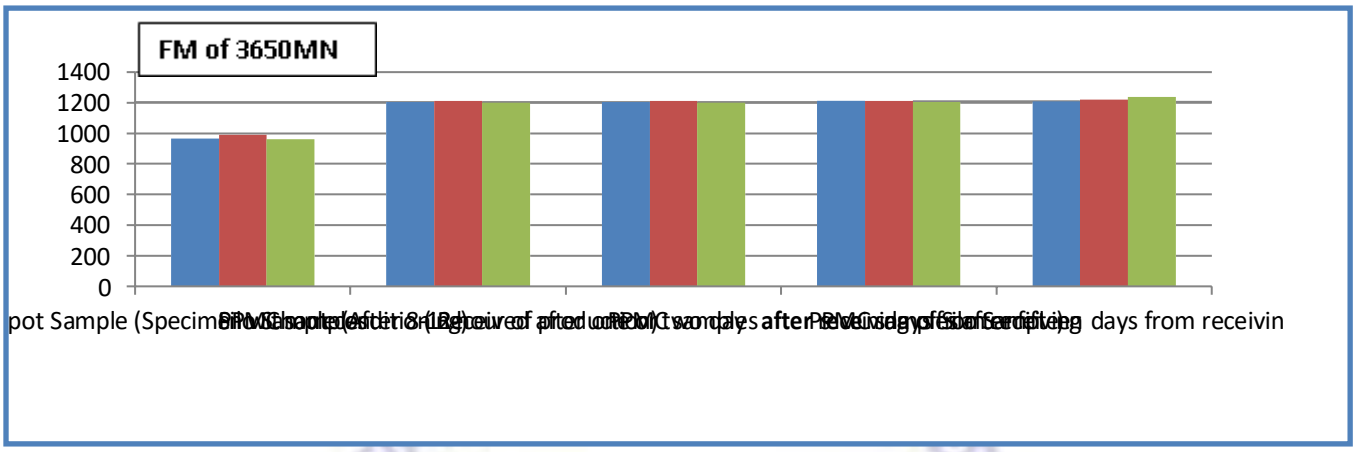





FM of 4100 MH
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample)
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving

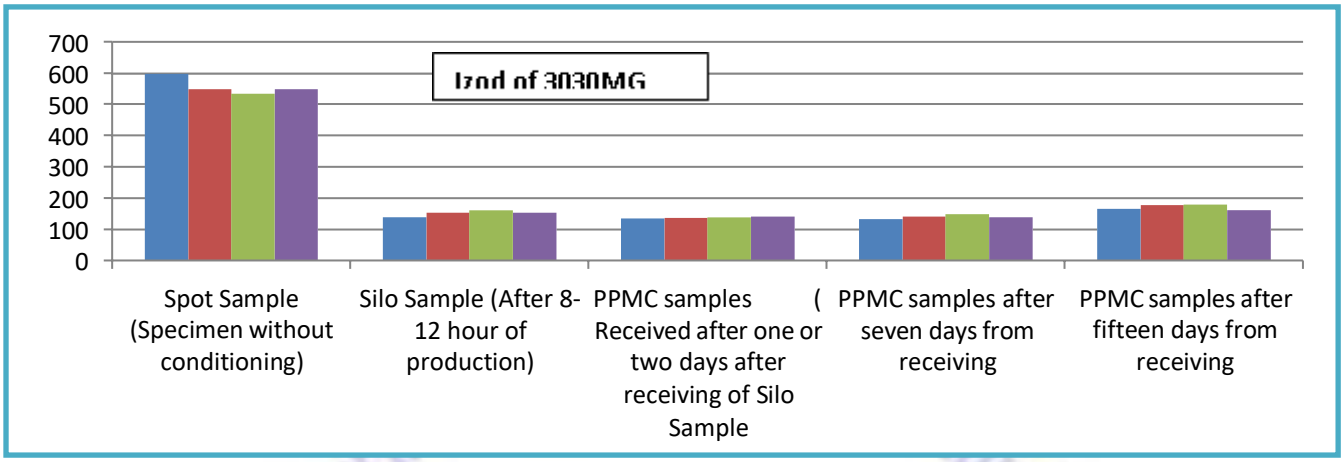

FM of 3120 MA
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample)
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving

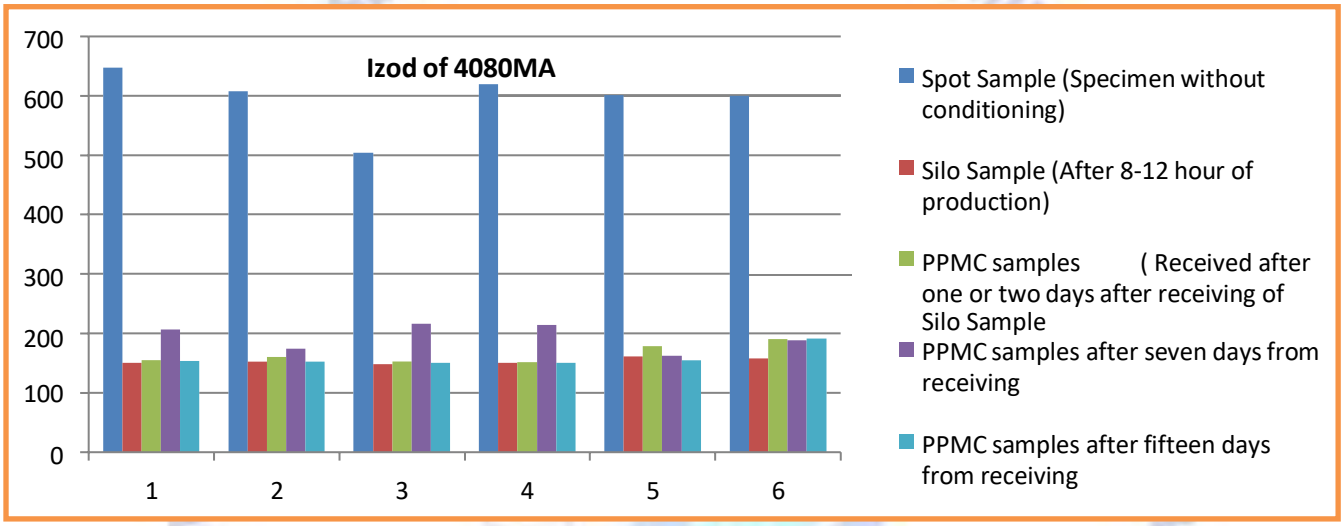

FM of 3400MN
1400
1200
1000
800
600
400
200
0
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample)
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving

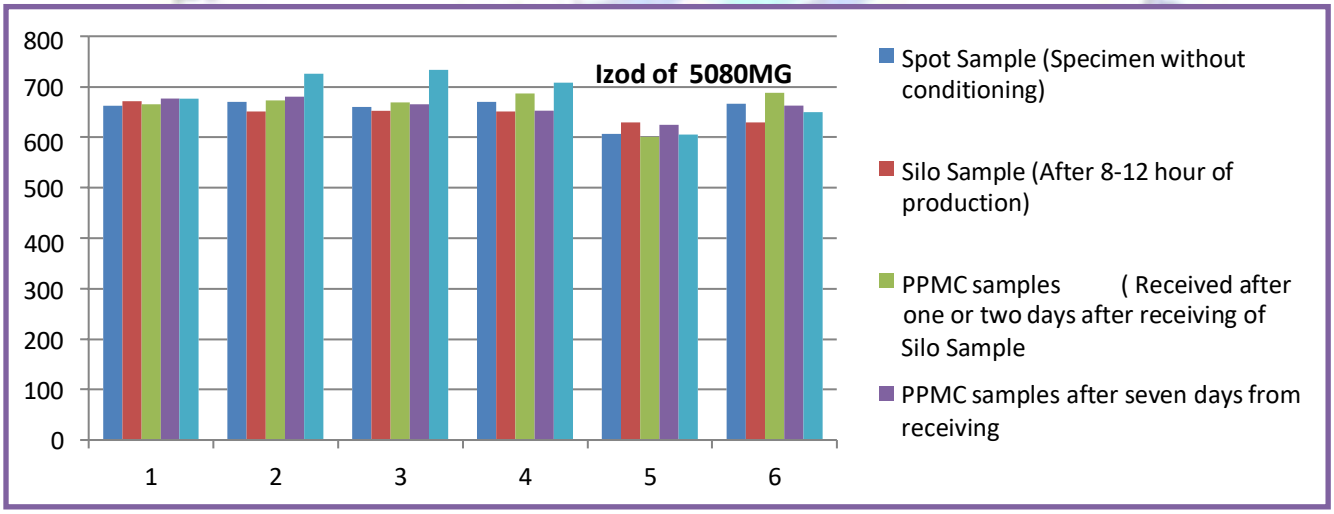


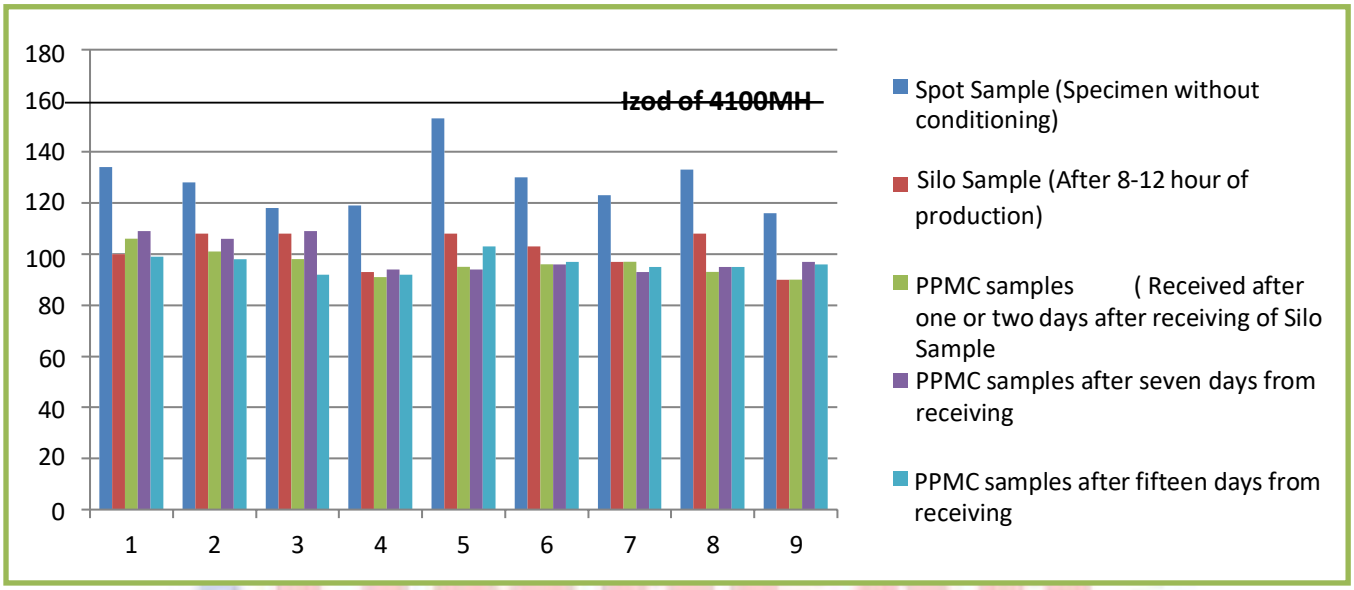
Test Results of Izod (J/m)							
Sr. No.	Grade	Spot Sample (Specimen without conditioning)	Silo Sample (After 8-12 hour of production)	Difference Between Spot & Silo Test Results (%)	PPMC samples (Received after one or two days after receiving of Silo Sample	PPMC samples after seven days from receiving	PPMC samples after fifteen days from receiving
1	3030MG	598	138	76.9	135	133	165
2		549	153	72.1	137	140	178
3		533	160	70.0	139	149	179
4		547	153	72.0	140	139	161
5	4080MA	647	150	76.8	155	168	154
6		607	152	75.0	160	174	153
7		504	148	70.6	152	175	150
8		619	150	75.8	151	178	150
9		601	161	73.2	178	162	155
10		600	158	73.3	190	188	191
11	5080MG	663	672	-1.4	665	676	677
12		670	651	2.8	673	680	726
13		660	653	1.1	669	665	733
14		670	651	2.8	687	652	708
15		607	629	-3.6	600	625	605

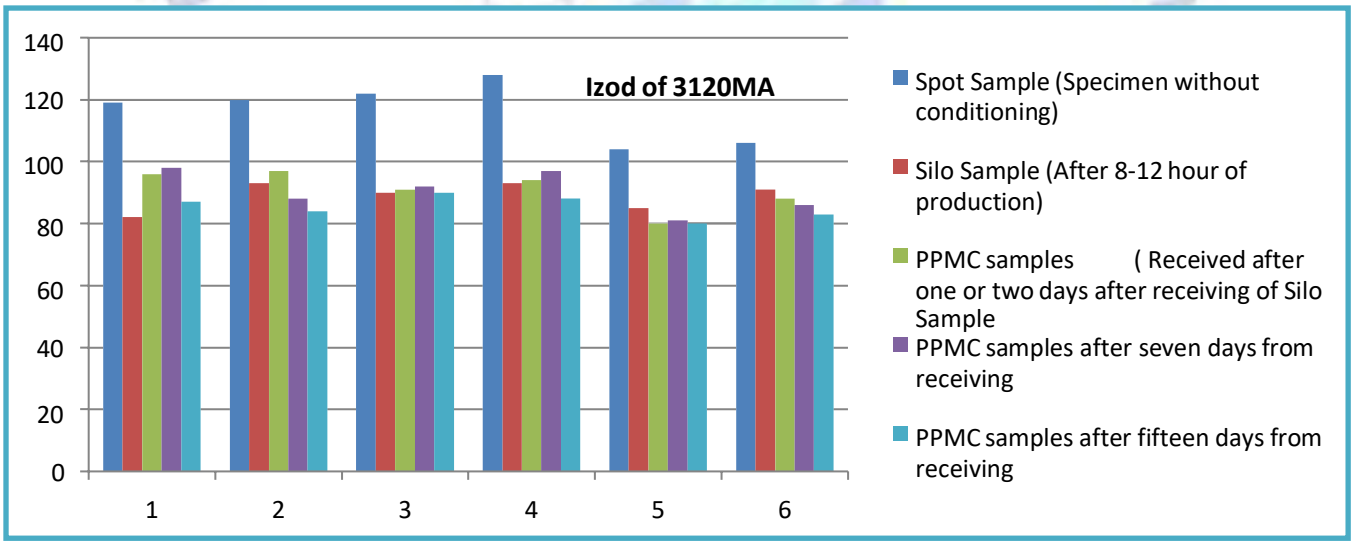
16		666	630	5.4	688	662	650
17	**4100MH**	134	100	25.4	106	109	99
18		128	108	15.6	101	106	98
19		118	108	8.5	98	109	92
20		119	93	21.8	91	94	92
21		153	108	29.4	95	94	103
22		130	103	20.8	96	96	97
23		123	97	21.1	97	93	95
24		133	108	18.8	93	95	95
25		116	90	22.4	90	97	96
26	**3120MA**	119	82	31.1	96	98	87
27		120	93	22.5	97	88	84
28		122	90	26.2	91	92	90
29		128	93	27.3	94	97	88
30		104	85	18.3	80	81	80
31		106	91	14.15	88	86	83
32	**3400MN**	78	73	6.4	71	66	70
33		84	65	22.6	76	69	59
34		82	75	8.5	74	74	68
35		88	63	28.4	69	58	64
36	**3650MN**	80	63	21.3	64	62	62
37		86	61	29.1	66	64	63
38		82	66	19.5	60	60	60
39		82	71	13.4	61	68	62

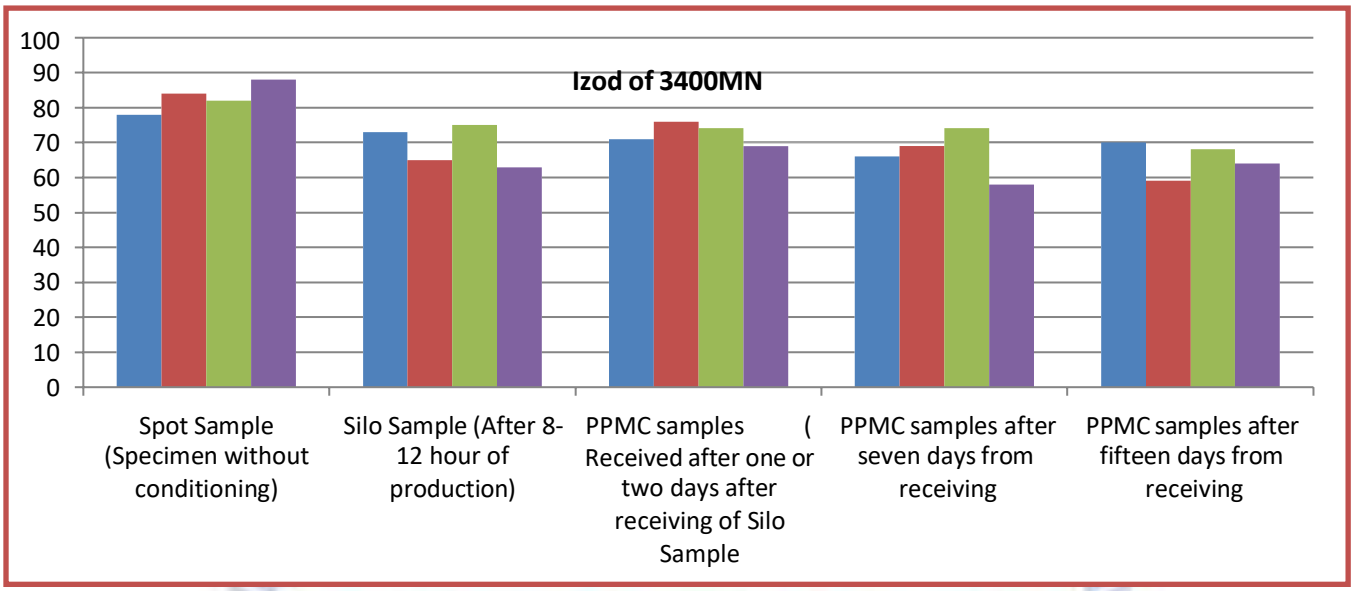

700
600
500
400
300
200
100
0
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving

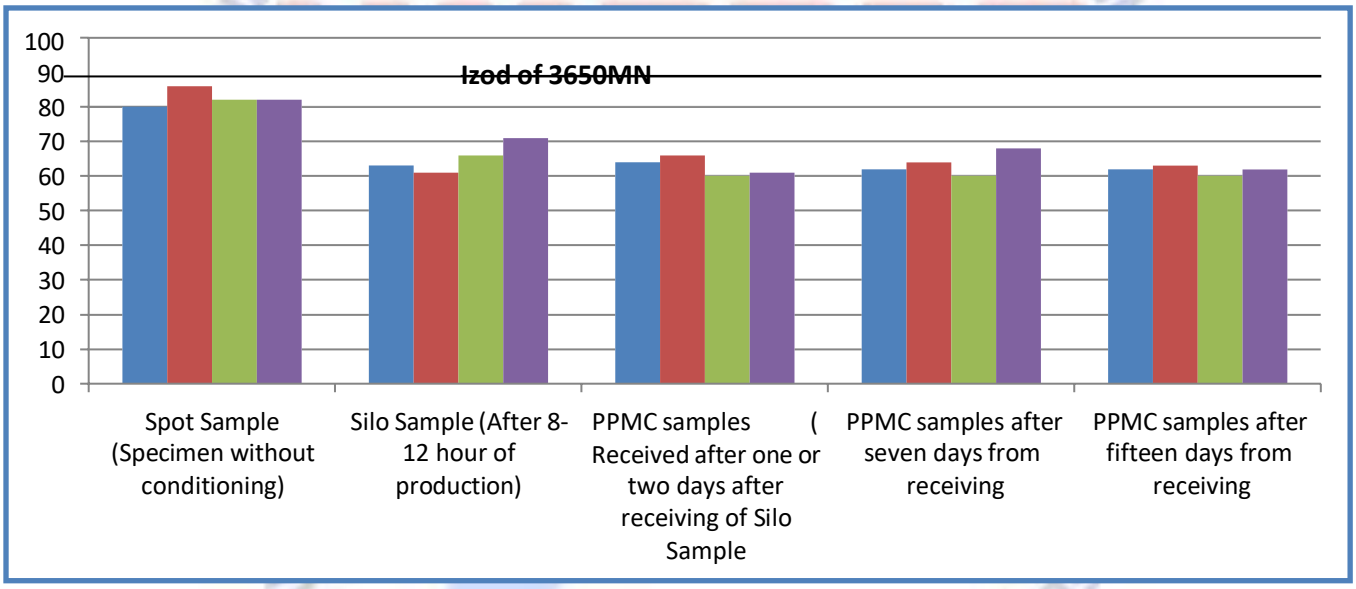

Izod of 4080MA
700
600
500
400
300
200
100
0
1
2
3
4
5
6
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving


Izod of 5080MG
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample
PPMC samples after seven days from receiving


Izod of 4100MH
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving


Izod of 3120MA
140
120
100
80
60
40
20
0
1
2
3
4
5
6
Spot Sample (Specimen without conditioning)
Silo Sample (After 8-12 hour of production)
PPMC samples (Received after one or two days after receiving of Silo Sample
PPMC samples after seven days from receiving
PPMC samples after fifteen days from receiving





Conclusion-

The core objective of the present work was the systematic study of variation of flexural modulus and Izod impact strength of impact-copolymers of poly propylene materials with time. The materials were stored in a static condition. The changes in FM and IZOD values of different impact co-polymers during transition period from a plant to costumer end (Generally, after production, it requires minimum 15 days for any polymer material to reach customer or marketing end) were reported and discussed under stipulated set of conditions and with a regular time interval for all samples. From this study, it can be concluded that no notable change would be found at customer end in FM & Izod of PPMC samples, if used within 15 days from production.

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