MAGNECHEM

PBP

A PALM OIL BASED CHEMICAL

The World's Next Milestone

Certified by: SGS

In collaboration with: MPOB

TRANSFORMING GREAT IDEAS INTO REALITY

Plasticizer is a type of chemical additive that helps softens and make a rigid material flexible for molding. Of all plasticizer consumption, 90% is used in PVC plastic. The addition of plasticizer, depending on content and type, improves the performance of a PVC plastic by making it flexible and durable.

PLASTICIZERS OVERVIEW

PVC plastic is used virtually in all applications globally. It can be used for medical applications, home ware, automotive, toys, construction, packaging, food packaging, cling wrap, stretch film etc. It is one of the highest consumed materials in the world. Therefore, there is a demand for various types of plasticizer for different grades of plastic and applications. Plasticizers are mostly derived from crude oil. Very much like the different grades of automotive petroleum, plasticizer, too, have various formulations to provide different properties and applications. Some of the types of plasticizers are phthalate base, trimallitates, adipates and vegetable-oil base.

The most widely used plasticizer is the phthalate-based plasticizer, which accounts to 84% market share. As for the total phthalate consumed, 54% are DOP. In other words, DOP is the most commonly used plasticizer in the world and it is now considered hazardous and toxic by many countries due to the environmental and health threats it poses.

HEALTH AND ENVIRONMENTAL HAZARDS

Derived from crude oil, plasticizer poses numerous environmental and health hazards. Exposure of plasticizer nowadays is high and it is easily affecting users.
DOP plasticizer easily evaporates into the air. Its high permeation property allows it to surface from the plastic/ PVC products and evaporates into closed atmospheric environments. The scent of a new car interior is contributed by the volatility of DOP plasticizers. The advice where we are encouraged to leave our windows open for awhile to let new air fill the car interior is actually important to avoid inhaling high doses of DOP plasticizer into our bodies.

Considering the fact that it is highly permeble, DOP plasticizer is easily absorbed into food and beverages. Plastic food containers and plastic water bottles contain DOP plasticizer. When in contact with food and beverages, the plasticizer will permeate and mix into its contents. Studies have found that food and beverages contained in plastic containers contains traces of DOP plasticizer. This also explains why food and beverages will have a different taste when contained in a plastic container for too long and it is hazardous to health.

GOVERNEMENT REGULATIONS

With the aforementioned threats and hazards, governments in various countries have tighten regulation in regards to DOP contents in children's toys, food-contact products and other plastic/PVC products. Globally, countries are seeking to eventually phase out the use of DOP in plastics and PVC.
The regulations have forced manufacturers to look for DOP alternatives. Some manufacturers opt for other crude-oil based alternatives such as DINP, while others would opt for Bio-based derivatives which have met with challenges.

OUR PRODUCT

PBP is a palm-oil based product that could be used as a plasticizer or a processing aid oil for rubber. It is formulated to replace DOP plasticizer and other types of crude-oil based processing aids. PBP is derived from a specific palm oil grade and so far we are the only company in Malaysia that have discovered this formulation derived from this specific grade.

Our research lead us to use one specific grade of palm oil to produce the PBP in a new, specially designed reaction process that is patented by us.

PROPERTIES

- PBP exhbits a clear appearance which eleminates the need to adjust the pigment coloring of plastic products
- Enhances the mechanical and thermal properties of PVC with resistance to heat, light and increase in tensile strength.
- Improves entanglement with PVC matrix which prevents it from migrating and leeching out to the environment and the organisms via direct contact with skin and tissue.
- PBP is ROHS compliant and an SGS report was compiled (attached) to showcase the zero toxicity of the product.

PBP PROPERTIES

Property Name	Value
Specific Gravity @ 25°C	0.9259
Viscosity @ 25°C, mPa.s	13.2
Flash Point, °C	192
Pour Point, °C	9
Appearance	Clear
Reflective Index @ 40°C	1.4452
Acid Value, mgKOH/g	1.75
Water Content, %	0.19
Iodine Value (WIJ'S)	2.81

PBP ADVANTAGES

01

NON TOXIC

- Dervied from edible palm oil, PBP plasticizer is non toxic.
- Safe for food-contact plastics such as cling-wrap, plastic food containers, medical containers, blood bags, etc.

02

BIODEGRADABLE

- PBP is a bio-based chemical additive. It is biodegradable and will not leave toxic residue waste.

03

SUBSTITUTES DOP/DINP/PETROL BASED PROCESSING OILS BY 100%

- PBP Plasticizer is tested and proven to be able to replace DOP completely. A viable DOP substitue.
- Performs at least the same or better than DOP or DINP

04

COMPETITIVELY PRICED AGAINST DOP/DINP

- Our PBP Plasticizer is competitively priced against DOP.
- Switching to PBP from DOP/DINP has no extra cost and might generate savings.

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PRODUCT RESULTS AND COMPARISION

LGM (MALAYSIAN RUBBER BOARD)

The Malaysian Rubber Board (MRB) is the custodian of the rubber industry in Malaysia. Established on 1 January 1998, it has under its fold three well established agencies (RRIM, MRRDB and MRELB), which are now merged into one, which have contributed significantly to the development of the rubber industry for the last 78 years. The R&D excellence in NR, accomplished by the Rubber Research Institute of Malaysia (RRIM), has had an impact on the Malaysian NR industry and other NR producing countries.

The primary objective of MRB is to assist in the development and modernisation of the Malaysian rubber industry in all aspects from cultivation of the rubber tree, the extraction and processing of its raw rubber, the manufacture of rubber products and the marketing of rubber and rubber products.

> LGM tests include material or product testing that include chemical analysis, physical testing, tyre testing, calibration of equipment and environmental related testing that follow either in-house test methods or MS, ASTM, BS/EN, ISO, JIS etc.

CONTACT & ADDRESS

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Fax: +603-6141 2907
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LGM TEST RESULTS

Rheological properties of compounds at 150°C

Compound	1 NBR/DOP	2 NBR/PBP-EPO	3 ENR50/DOP	4 ENR50/PBP-EPO
Minimum torque(M_L), dNm	0.50	0.65	0.09	1.30
Maximum torque(M_H), dNm	8.53	5.45	11.17	10.71
Delta torque,(M_H - M_L), dNm	8.08	4.80	11.08	9.41
Optimum cure time, tc_{95}, min	100	49.24	45.81	31.55
Scorch time,ts_2, min	17.91	16.69	10.12	10.71

Mooney viscosity and scorch of compounds

Compound	1 NBR/DOP	2 NBR/PBP-EPO	3 ENR50/DOP	4 ENR50/PBP-EPO
Master batch, ML(1+4)@100°C	34.0	39.5	-	-
Compound, ML(1+4)@100°C	28.1	34.3	34.3	41.0

Physical properties (cured at 150°C)

Compound	1 NBR/DOP	2 NBR/PBP-EPO	3 ENR50/DOP	4 ENR50/PBP-EPO
Tensile strength, MPa	7.18	9.40	6.17	4.73
Elongation at break, %	346	461	1015	611
M100, MPa	1.73	1.62	0.69	0.93
M300, MPa	6.08	4.99	1.31	2.13
Hardness, IRHD	48	49	42	35
Hardness, Shore A	53	55	50	44
Compression set, 72h/100°C	61.17	81.32	77.90	98.36
Compression set, 72h/70°C	11.65	17.61	27.00	33.00
Abrasion, %, ARI	49.21	49.55	64.98	42.48
Abrasion, Volume loss,cm^3	0.2864	0.2845	0.2152	0.3292
Density, g/cm^3	1.1460	1.1451	1.1038	1.1039
Tear strength, crescent, kN/m	14.13	14.32	14.88	17.44
Dunlop Resilience	-	-	-	-

Physical properties after ageing (70°C/7 days)

Compound	1	2	3	4
	NBR/DOP	NBR/PBP-EPO	ENR50/DOP	ENR50/PBP-EPO
Tensile strength, MPa	8.76	10.31	4.78	6.83
Elongation at break, %	324	425	498	878
M100, MPa	2.28	2.02	1.10	0.78
M300, MPa	7.94	6.49	2.67	1.61
Hardness, IRHD	52	53	48	40
Hardness, Shore A	55	55	50	44

Physical properties after swelling in ASTM 1 (70°C/ 7 days)

Compound	1	2	3	4
	NBR/DOP	NBR/PBP-EPO	ENR50/DOP	ENR50/PBP-EPO
Tensile strength, MPa	8.11	9.39	6.94	9.10
Elongation at break, %	300	391	647	877
M100, MPa	2.33	2.17	1.25	1.07
M300, MPa	7.76	6.59	2.65	2.03

Physical properties after swelling in ASTM 3 (70°C/ 7 days)

Compound	1	2	3	4
	NBR/DOP	NBR/PBP-EPO	ENR50/DOP	ENR50/PBP-EPO
Tensile strength, MPa	4.92	4.20	6.21	4.73
Elongation at break, %	213	236	589	710
M100, MPa	1.86	1.61	1.19	0.98
M300, MPa	-	-	2.72	1.84

Physical properties after swelling in Toluene(70°C/ 7 days)

Compound	1	2	3	4
	NBR/DOP	NBR/PBP-EPO	ENR50/DOP	ENR50/PBP-EPO
Tensile strength, MPa	1.80	2.19	1.06	0.98
Elongation at break, %	81	118	143	259
M100, MPa	-	1.88	0.76	0.40
M300, MPa	-	-	-	-

LGM TEST RESULTS SUMMERY

It's clear from the test performed that rubber infused with PBP is highly comparable with its counterpart DOP. Meaning that replacing pathalate based plasticezers is possible with our product.
A closer look at the results shows in some cases better properties than the DOP.
We beleive with further tests, our product could be the first of its kind to completely substistue DOP or DINP. Furtheremore, it's the one of the few if not the only product that is fully green and 100% safe to be exposed to.

THIRD PARTY TESTERS

PVC TEST

NATURAL RUBBER TEST

CLING WRAP TEST

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PVC TEST RESULTS

PVC Physical Properties Comparison Table: DOP, DINP & PBP

The following table shows the physical properties of PVC compounds made using plasticizers PBP, DOP and DINP respectively.

Properties	DOP40 *(40 phr)*	DINP40 *(40 phr)*	PBP40 *(40 phr)*	PBP30 *(30 phr)*	PBP24.5 *(24.5 phr)*
Tensile Strength, N/mm^2	25.5	25.0	22.7	25.9	30.2
Elongation, %	257	232	310	234	206
Hardness, Shore A	90	90A 44D	81	86A 41D	91A 50D
Specific Gravity	1.256	1.251	1.230	1.259	1.278
Surface Tact	Dry	Dry	Oily	Slightly Oily	Slightly Oily
Aging Test (100°C x 100 hours)					
Retention of Tensile Strength, %	101	100	108	108	97
Retention of Elongation, %	93	93	89	88	83
Mass Loss	1.0	0.7	3.2	3.9	2.6
Hardness Change					
Shore A	no change	-2A	+3A	+2A	+3A
Shore D	+5D	+1D	+2D	+4D	+5D
Appearance/ Colour Change	Slightly yellowish	Slightly yellowish	Slightly yellowish	Slightly yellowish	Slightly yellowish

Client Aging Test Results

Date : 3rd November 2016

Properties	Units	NRFL- PBP30			NRFL- PBP24.5		
Tensile Strength	N/mm2	25.9			30.2		
Elongation	%	234			206		
Hardness	Shore A	86A 41D			91A 50D		
Specific gravity		1.259			1.278		
Remarks		slightly oily surface			slightly oily surface		
Aging test		70°C x 96 hrs	70°C x 168 hrs	100°C x 100 hrs	70°C x 96 hrs	70°C x 168 hrs	100°C x 100 hrs
Retention of Tensile Strength	%	104	103	108	92	93	97
Retention of Elongation	%	104	95	88	98	100	83
Mass Loss	%	0.7	0.9	3.9	0.8	1.0	2.6
Hardness change	point						
Shore A		−1A	+3A	−2A	+1A	+1A	−3A
Shore D		−2D	+3D	−4D	+4D	+4D	−5D
Appearance / colour change	point	Negligible change in colour	Very slight yellow tinge	Slightly yellowish	Negligible change in colour	Very slight yellow tinge	Slightly yellowsih
Dosage of plasticizer	phr	30	30	30	24.5	24.5	24.5

PVC TEST RESULTS SUMMERY

The PVC test was done by independent compounder that is a supplier of specialized formulated Polyvinyl Chloride (PVC) compounds, vinyl and olefinic based Thermoplastic Elastomer (TPE) compounds for the application of parts and articles for various industries such as building & construction, automotive, electrical & electronic and many others.
The hardness of PBP30 is similar to DINP40, which means that plasticizing effect of plasticizer PBP is higher.
The mass loss after aging test for PBP is higher. This is due to higher evaporation.

NATURAL RUBBER TEST RESULTS

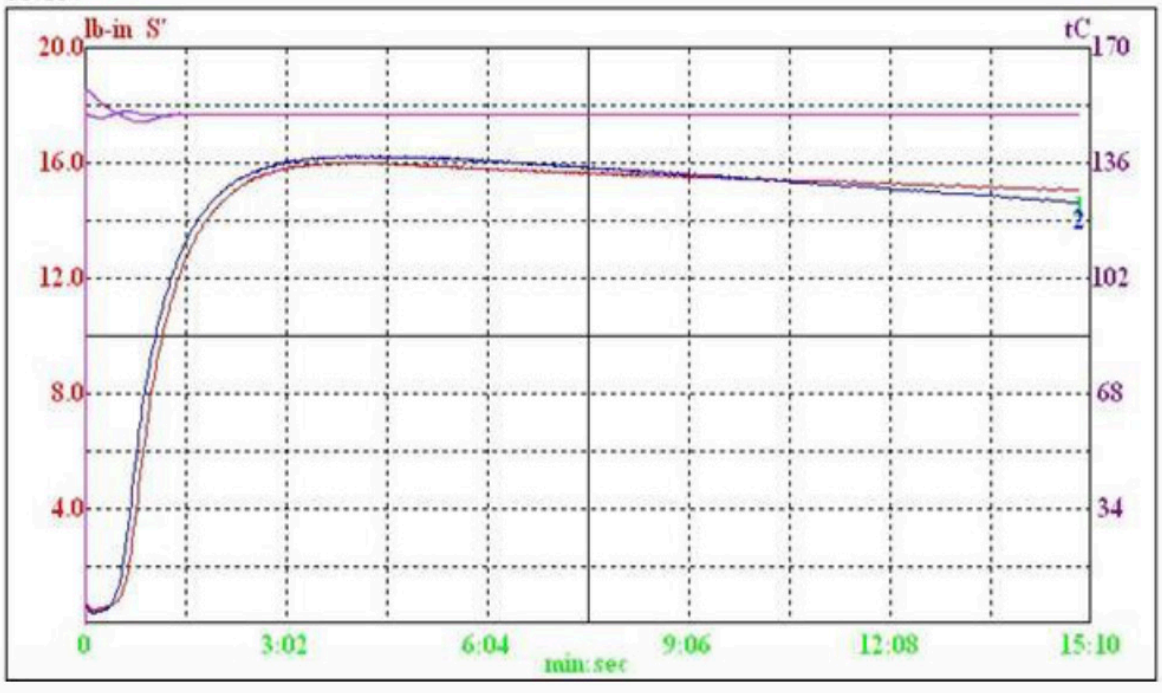
			150`C x 5 min	
Test	**Method**	**Unit**	**Sample A**	**Sample B**
Tensile Strenght @ Break	ASTM D412-06a	Mpa	11.9	13.7
Elongation @ Break	ASTM D412-06a	%	214	230
M100	ASTM D412-06a	MPa	5.8	6.3
Density	ISO 2781	g/cm3	1.22	1.22
Hardness	ASTM D 2240-05	shore a	80	80

RHEOMETRIC TEST

Customer :Magnechem
Material :NR
Arc. Size : + / - 0.5 deg
Ref No. : LJRF
Date : 25-Oct-16
Remark : Temp 150`C
Batch No :

No.	Material	Batch No.	Test Date	MH lb-in	ML lb-in	ts2 m:s	tc90 m:s	tc95 m:s	tc100 m:s	DT(MH-ML) lb-in	tc90-ts2 m:s	Temp(Low)@ML C
1	NR (sample A)		10/24/2016	15.99	0.49	0:42	2:00	2:24	3:45	15.50	1:18	149.7
2	NR (sample B)		10/24/2016	16.22	0.38	0:36	1:55	2:21	4:04	15.84	1:18	154.6
Avg	0.0000000000000	0.0	10.0000000000	16.10	0.44	0:39	1:58	2:22	3:54	15.67	1:18	152.1

GOTECH



NATURAL RUBBER TEST RESULTS SUMMERY

This test was performed by an independant tester who is also a supplier for a wide spectrum of industries namely specialty plastic products, rubber products, adhesive, sealant, coating, rubber & plastic compounds, wire & cable, packaging and lubricant.

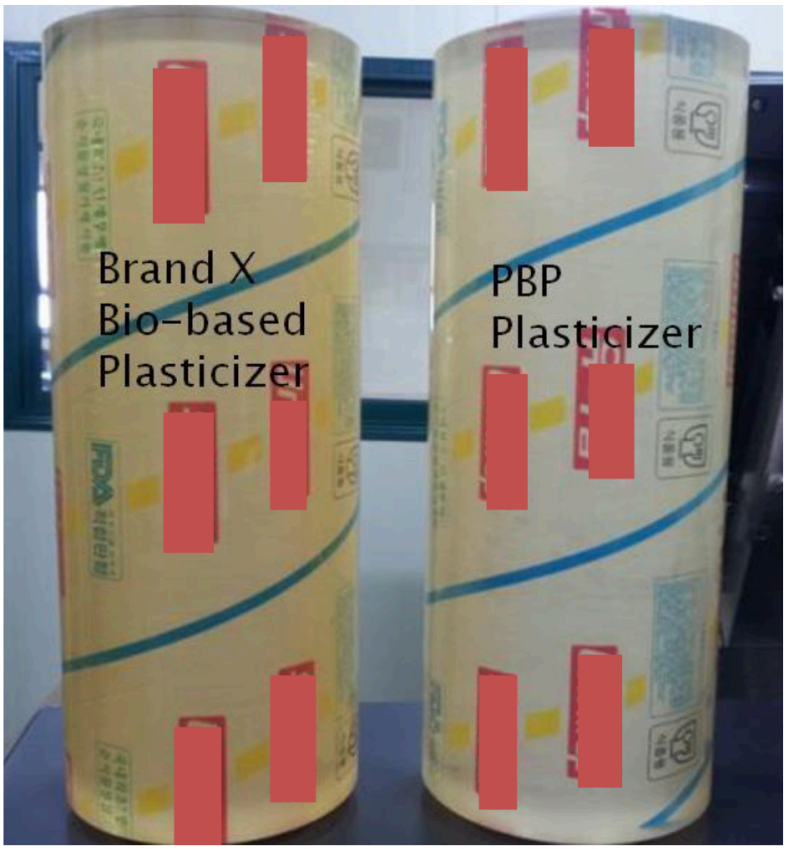
It's clear from the test performed that natural rubber infused with PBP as a processing oil and cured at 150˚C for 5 minutes, exhibited a better tensile strength and elongation. This means that in the preperation of natural rubber, the other processing oil could be entirly replaced with our green chemical that is of a competitive price and without any compromisations regarding physical properties.

CLING WRAP TEST RESULTS

(Tested on 2015.04.09)

Inspection Item		Unit	Standard	Result	
				Current product	PBP (Magnechem)
Thickness per weight		μm	-	12.44	12.61
Elongation	TD	%	300 Min.	325.9	323.6
	MD		180 Min.	198.0	224.6
Tensile Strength	TD	Kgf/mm²	1.2 Min.	1.31	**1.15**
	MD		1.8 Min.	2.10	1.95
Unwind force		N	-	4.655	**6.996**

The following picture shows the color difference between a bio-based plasticizer and our PBP, tested on a cling wrap. The test was done by a south korean cling wrap manufacturer.



Our PBP plasticizer results in clearer colouring.

PRODUCT APPLICATIONS

Applications of PBP include but not limited to:

Cling-wrap

Plastic food containers

Children's toys

General Plastic products

Paint

Automotive Dash-Board

Rubber Products

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CONTACT US

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