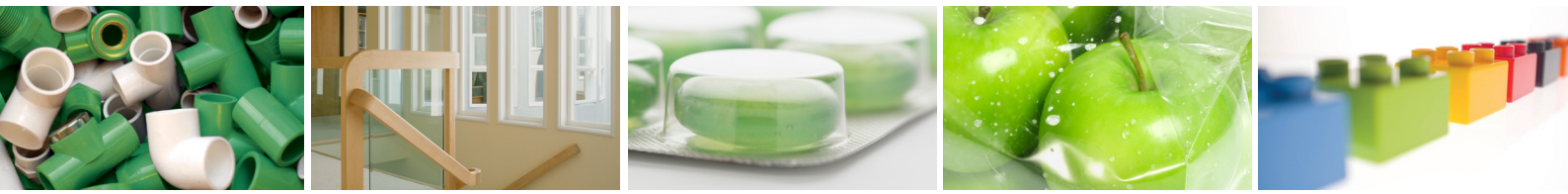


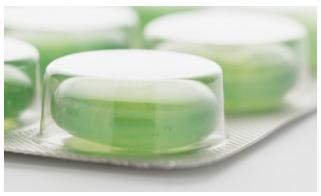
100 % Biobased Polymeric Plasticizers
EDENOL® 2178 and EDENOL® 2192

Highlights

- 100 % biobased building blocks, all compliant with indirect food contact regulations for plastics
- REACH exempted as polymers
- Applied for EU 10/2011 food contact compliance status
- Readily biodegradable
- Differ in molecular weight thus in viscosity, so it might be used as:
  - Single plasticizer or flexibilizer,
  - In combination with each other,
  - In combination with other plasticizers
- Performance in both **bioplastics** and PVC
- Biobased polymer additives since 1957

Did you know?
While bioplastic articles such as bags or cutlery are assessed by their ***compostability,*** *additives for bioplastics are assessed by their* ***biodegradability****!*





Why Plasticizers?

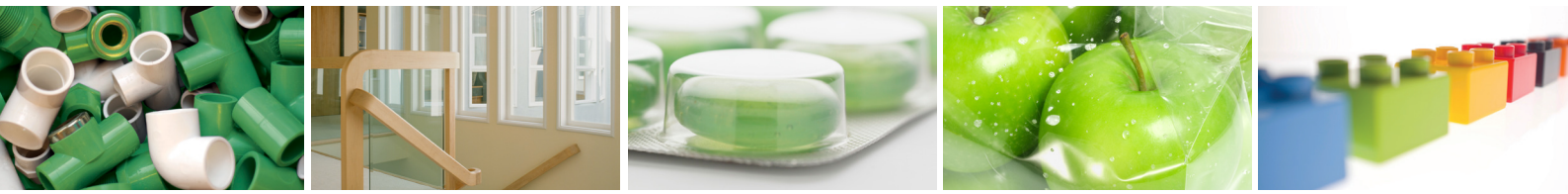
Plasticizers are used in polymers to make the material softer and/or more flexible. Plasticizers need to be highly compatible with the polymer matrix as they are used at a very high dosage in the double-digit percent range. A high compatibility helps to avoid application issues such as exudation upon aging, weathering or mechanical stress of the plastic article, or undesired extraction when in contact with liquids such as soapy water or edible oils. Typical standard (monomeric) plasticizers include phthalate, terephthalate, cyclohexanedicarboxylate or adipate esters.

Why Polymeric?

Polymeric plasticizers provide a higher or even higher molecular weight compared with monomeric ones. The weight and thus the size of their molecules provides these plasticizers a improved resistance to undesired migration or exudation. In addition, by smart choice and combination of the polymeric building blocks, the plasticizer's polarity and so its compatibility to the polymer can be tailored.

Why Biobased?

The entire chemical and polymer industry is striving to reduce the use of fossil-based carbon in their products as much as possible. Due to their high dosage rate in polymer matrices, plasticizers make up a considerable share of the carbon content in plastics applications. Therefore, by using an ideally 100 % biobased plasticizer, the biobased share of the plastics material can be increased significantly.



Application Data in PVC

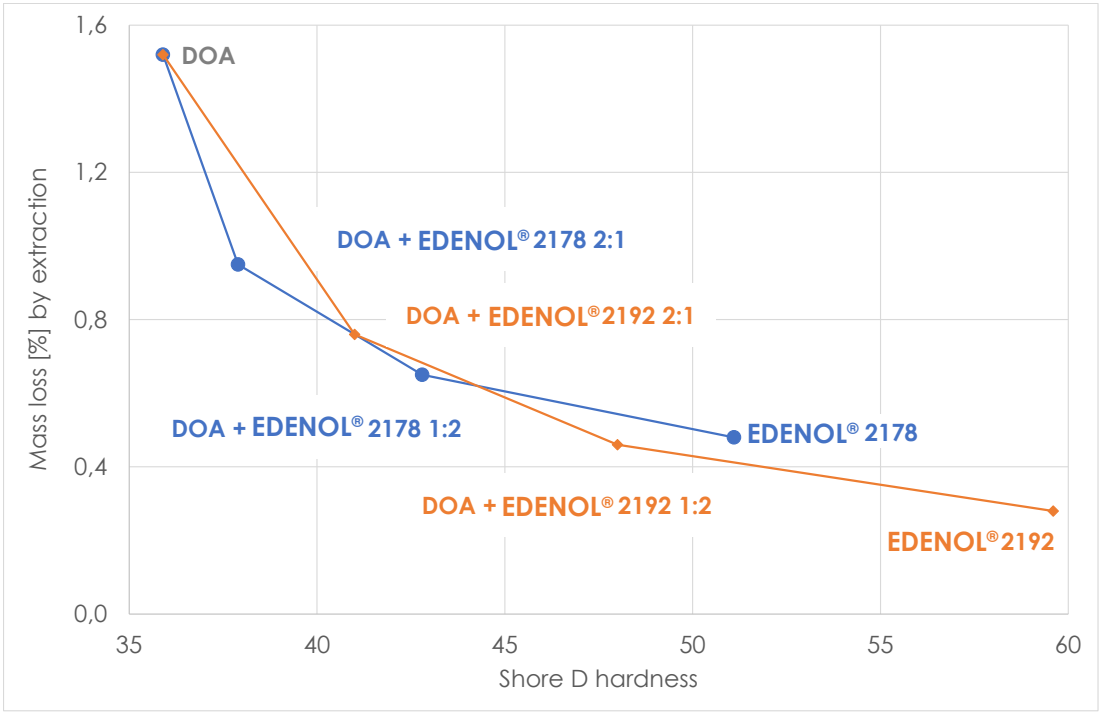
PVC is a very versatile material that can be used with or without plasticizers. Good plasticizers in PVC provide not only a low Shore hardness, but low extraction resistance as well.

Di(2-ethyl hexyl) adipate (DEHA, or DOA), EDENOL® 2178 and EDENOL® 2192 were compounded in PVC k 71 at 40 phr using a two roll mill. The plasticizers were used both in neat form and as blends.

The 0.5 mm milled sheets were compacted to 3 mm pressed sheets, which were then used as specimens to compare Shore D Hardness and extraction resistance in isooctane (4 h/60 °C).

The figure below shows the values for Shore D hardness (x axis) and mass loss by extraction (y axis) for the above mentioned plasticizers and their blends.

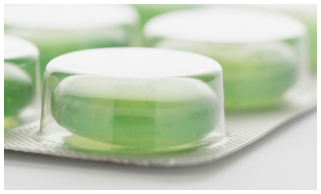
It is obvious that the monomeric plasticizer DOA provides a distinctly lower Shore hardness, but higher mass loss compared with the polymeric plasticizers. However, the crucial finding of this analysis is that by replacing monomeric plasticizer DOA by one of the polymeric plasticizers, the extraction resistance can be clearly improved while rarely compromising Shore hardness.



Analyzing the mechanical properties of the milled sheets confirmed, that replacing DOA by a 2:1 blend of DOA and EDENOL® 2178 or EDENOL® 2192, does not alter the tensile strength and module too much. However, it results in an approximately 35 % reduction in mass loss as shown in the above figure.

Detailed results can be shared on request.





Application Data in Bioplastics

Emery Oleochemicals benchmarked **EDENOL® 2178** and **EDENOL® 2192**, while still using the corresponding trial products MC 2178 and MC 2192, with various other plasticizers commonly used in bioplastics [1].

Those common plasticizers were **glycerin**, its acetic acid ester **triacetin**, citric acid ester **ATBC** and epoxidized soy bean oil **ESBO**. The test included **PBAT** as well, which is a polymer often used in PLA blends to improve mechanical properties. Besides the EDENOL® plasticizers, only glycerin and ESBO have a biobased carbon content of 100 %. All plasticizers were compounded into PLA at a 10 % dosage to produce sheets by injection molding and to punch tension rods out of these sheets.

None of the plasticizers reduced the Shore hardness of PLA significantly. As a consequence, they should rather be considered flexibilizers instead. While glycerin showed strong exudation at room temperature already, the other plasticizers were compatible. Apart from PLA/ESBO, which stood back with regards to mechanical properties, the remaining plasticized compounds showed all in all a comparable performance. As a conclusion, **EDENOL® 2178 and EDENOL® 2192 were the only 100 % biobased plasticizers in this test that provided superior flexibilizing performance.** For more information, please refer to [1].

EDENOL® 2178 and **EDENOL® 2192** are available immediately. Please refer to the most current technical and safety data sheets and contact your nearest Green Polymer Additives sales manager or distributor for additional information.

[1] Bioplastics Magazine, Vol. 02/2021 Mar/Apr, p. 16-17
https://epaper.bioplasticsmagazine.com/issue-02-2021/65434695

Updated: 19-05-22

For more information, contact your nearest regional office.

Americas: gp.americas@emeryoleo.com Europe: gp.europe@emeryoleo.com Asia: gp.asia@emeryoleo.com