GREEN - GREENER - BIO?

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The petrochemical way in base chemicals has been on scrunity for it's long-term sustainability for some time. Materials based on renewable raw materials are becoming more and more popular. For paints and coatings it is good to start with the bulk material - the polymer. By Nina Musche.

Petrochemical raw materials are still the standard in the chemical industry and thus also in the paint and coatings industry. However, there are options to change this, especially in the area of binders. Looking back, raw materials from nature have always been used in paints and coatings: egg yolks, linseed oil, copal resins. Many of these are certainly no longer available in sufficient quantities or qualities, but there is a major trend to use natural oils

Company	Product name	Chemical basis	Solids content	Medium	Specific properties	Application
Alberdingk Boley	Alberdingk Ren U 400 N	Aliphatic polyether polyurethan dispersion	~40 %	Water	MFFT 0 °C	Adhesives, lamination of textile, wood and foils
	Alberdingk Ren U 4000	Aliphatic polyurethane dispersion	~28 %	Water	MFFT 0 °C	Primer on plastic substrates (corona treated BOPP)
BASF	Laromer EA 9143 Eco	Epoxy acrylate	100 %	--	Reactivity via double bonds 2.3	UV-sealer and -topcoats
	Sovermol 1005	Castor oil based polyol	--	--	Hydroxyl number 117-130 mg KOH/g	Manufacturing polyurethanes for 2 ack coatings, floorings and adhesives
Covestro	Bayhydur eco 701 90	Aliphatic polyisocyanate, b. o. PDI	~90 %	Propylene glycol diacetate	NCO content 17.9 %	Water-borne 2-component coatings based acrylic emulsion or polyurethane dispersion
	Desmodur eco N 7300	Aliphatic polyisocyanate, b. o. PDI-trimer	100 %	--	NCO content 21.9 %	Lightfast solvent-borne polyurethanes, blend partners can be polyester and polyacrylate polyols and other polyisocyanates
Hobum	Isomergin acid SY	Natural fatty acids, unsaturated	100 %	--	Acid value 198-202 mg KOH/g	Manufacturing of alkyd resins, epoxy esters, modified epoxies, water soluble alkdys
	Merginol 901	Aliphatic polyester/ -ether polyol	100 %	--	Hydroxyl number 290-330 mgKOH/g	Manufacturing 2-component coatings, sealants, primers
Lubrizol	Aptalon 8080HS	Polyamide polyol polyurethane dispersion	50 %	Water	--	Clear wood finishes
	Carboset AMO 400	Acrylic modified oil copolymer dispersion	40 %	Water	MFFT 12 °C	Wiping stains, sanding sealers, general interior wood coatings
Worlée	WorléeKyd RL 1290	Linseed oil based alkyd	100 %	--	Oil content 90 %	Low VOC and VOC-free parquet-, terrace- and maintenance oils, wood stains and glazing
	WorléeSol 31 C	Modified linseed oil polymer	45 %	Water/ Dowanol PnB 80:20	Acid value 90-140 mg KOH/g	Exterior wood stains and preservatives

again for the production of binders. It is important to control the production of the oils at their origin. Also the cultivation and first processing on site should be sustainable. The first commercial projects are also using regional raw materials that create real synergies with existing plants. It offers farmers the opportunity for additional income without reducing the area available for food cultivation. If the processing into a sales product can then also take place in the region, the CO_2 footprint will be even smaller. If the focus is solely on "renewable", the CO_2 footprint can become as large as you like. Cultivation on cleared rainforest areas and long transport routes can have a very negative effect on the balance, even if the raw materials are renewable.

Other options include the usage of bacteria or funghi to produce building blocks like alcohols. Bio-ethanol is one example here. Produced from bio mass of crop waste via fermentation, it can be used in various chemical production processes. Last question: how would you judge the use of bio-gas instead of fossil gas in the cracker to produce building blocks for the downstream chemistry?

The table includes products for the production of polyurethanes and other polymers as well as finished binders and crosslinkers. The proportion of renewable raw materials cannot yet be 100 % everywhere, but it gives an overview on the status quo.

Renewable content	Properties
~68 %	High water resistance, solvent free, elongation at break 500 %, E- Modulus 6.5 N/mm²
~57 %	Solvent free, adhesion to (treated) plastics, easy re-coatability, elongation at break 650 %, E-Modulus 5.0 N/mm²
~20 %	High chemical and scratch resistance, good reactivity, free of stenomeric monomers
100 %	Soft, elastic; hydrophobic; drinking and potable water applicable upon product specific confirmation
~61 %	Low odour, high chemical resistance, reliable incorporation (even with manual mixing)
~68 %	High chemical and weather resistance, gloss retention and mechanical properties
~100 %	UV-stable coatings, lowers viscosity and improves flow, hydrophobic and chemcial resistant
~80 %	UV-stable coatings, lowers viscosity and improves flow, hydrophobic and chemcial resistant
~35 %	High film thickness application, abrasion resistant, hard and tough films, formulations below102 g/L VOC, self-crosslinking
~ 50 %	Early sanding, blocking and print resistance, longer open times, self-crosslinking, formulates <25 g/L VOC
> 95 %	Low viscosity, good penetration, permanent elasticity and weather resistance
	Good wood penetration, durability, easy application, long-term elasticity, freeze-thaw stable

"Raw materials have the biggest CO_2 impact. The transformation to bio-based content is essential."

WEB TIP: EUROPEAN BIOMASS INDUSTRY ASSOCIATION (EUBIA)

Eubia's efforts consist of promoting and supporting new industry-oriented initiatives in cooperation with investors, small and large private enterprises. It gives a good overview on status quo and initiatives on their Internet presence.

www.eubia.org/cms/wiki-biomass/bio-based-products

IMPROVEMENT OF CORROSION PROTECTION BIO-BASED POLYMER EPOXY ACRYLATE

A new green binder of Jatropha-oil based epoxy acrylate (AEJO) resin was able to replace coatings in corrosion protection. The epoxy acrylate coating was blended with nano zinc oxide to make hybrid nanocomposites as a corrosion protection coating for steel. Characterised for corrosion protection performance by impedance spectroscopy (EIS) and salt spray tests. XRD analysis was conducted, and thermal properties by TGA studied. The surface morphology characterised by field emission scanning electron microscopy (FE-SEM). This study provides green-based materials and protection to surface.

Min Min Aung et. al., Ind. Eng. Chem. Res. 2020, 5, 1753–1763

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