



Alternative Natural Rubber

dandelion[☼] successful, next comes banana^{☼☼}

Zoz/Fraunhofer IME joint technology initiative

- sustainable biorefinery route for banana peels processing -
green⁺ rubber from dandelion, green⁺⁺ from waste-peels



(a) Natural Rubber (NR) from Hevea Brasiliensis, background

NR is obtained from rubber trees (*Hevea brasiliensis*) providing latex, growing within the “green belt” of the planet

- can technically not for 100% be replaced by synthetic rubber;
- market cost strongly fluctuating at increasing demand;
- from alternative resources known and challenging since WW-II.

(b) Alternative NR (ANR) from dandelion roots

Russian dandelion, resource for Continental Taraxagum™ [1-3]

- agrarian robust and undemanding, grows practically everywhere;
- results in high quality natural rubber in one step;
- no latex coagulation required – environmentally friendly (green) rubber !
- FHG-IME increased the rubber yield crop massively, comparable to rubber tree.

2015, Fraunhofer IME Dandelion Rubber Extraction Facility was set up at the Zoz Technology Center (ZTC) at Olpe/Germany [4].

2017, Continental took over the dandelion unit at ZTC and

2018, opens the Taraxagum™ Lab at Anklam, Germany [5].

2018. Zoz designed a continuous processing unit in pilot scale for the above [5].

In 5-10 years, Continental wants to be able to produce tires with ANR commercially. The goal is a more sustainable tyre production more independent from traditional NR sources [6].

(c1) next step - continuous processing

Zoz designed, manufactured and in first years also operated the batch processing plant for rubber-extraction from dandelion roots in pre-industrial scale successfully. Converting such process into continuous operation for commercial industrial product volumes is the next step.

(c2) next resources - banana peels (BP)

- availability of (c1) can open a new world in green⁺⁺ biorefinery offering a wide range of industrial utilization of quickly renewable natural resources;
- first flora candidate at high rubber content + available in large scale are banana peels;
- worldwide, about 135mio tons of bananas are cultivated, DE imports 1mio tons p.a.
- BP-waste at high volumes even in DE, as much as 30-40%wt (crop dry) of fresh fruit;
- BP degrades very slowly in composting, contains numerous pollutants from pesticides;
- including BP into product processing, prior or post transport, offers protection of the environment and value adding.

(c3) Biorefinery method for BP processing

For a biogas refinery, e. g. a particle size in mm-range seem to be ideal to optimize the methane yield where for extracting natural rubber, a similar process did lead to full success under (b).

- FHG-IME monitored the absorption of fine BP-particles in absorber material which was added to a water based wet-milling process, all in pilot experiments;
- in such process, also natural polyisoprene with a molecular weight of 10⁵-10⁶ Da at a mass ratio of about 1% of BP is extracted (Russian dandelion roots up to 15%);
- BP insofar represent a given 100% waste, dandelion roots represent the useful fraction of a cultivated plant, which brings BP to high interest as an ANR-resource.
- remaining slurry is composed of very fine organic material which could be easily mixed and used e.g. for injection moulding. All process avoids any organic solvents !

(c4) Industrial Partner wanted

Banana Processing Industry (from juice to baby-food to chips) can turn waste into value, saving ecological disposal difficulties, selling natural rubber to **Rubber Processing Industry** for a green image in short term and materials economics on mid/long term. Finally, the technology can be most probably transferred to a wide range of other plant waste products.

[1] C. Recker, A. Topp: Sustainable Tire Materials; Proceedings OZ-16 (2016)

[2] Chemie.de/news/153235 # 12.06.2015 # Naturkautschuk aus Löwenzahn

[3] www.taraxagum.de

[4] <http://medien.zoz.de/download/2016-06-02-dandelion-tires-at-oz-16/>

[5] 2019121015241800DE & 2019121015235500DE, both claimed by Zoz GmbH and Fraunhofer-IME

[6] <https://www.automobilwoche.de/article/20180828/AGENTURMELDUNGEN/308289950/neues-taraxagum-lab-in-anklam-conti-will-ab-herbst-loewenzahn-kautschuk-produzieren>

photos: <https://cosmosmagazine.com>, Zoz GmbH press release ZG-1609, www.freepik.com, www.seed-bank.ca, www.georgeperry.co.uk



Zoz-TRM at Anklam (left)



Taraxagum™ tyre at OZ-16 + OZ-18

