VERBAND DER CHEMISCHEN INDUSTRIE e.V.
WIR GESTALTEN ZUKUNFT.

VCI

*VCI Position Paper*

# Chances and limitations for the use of renewable raw materials in the chemical industry

## Core statements

- Renewable raw materials have been established for a long time in the chemical industry. They are used in applications where they bring technical, economic or other advantages.
- Resource efficiency and sustainability are important guiding principles for the chemical industry. The use of renewable raw materials only contributes to a sustainable development where it is advantageous also from ecological and social aspects – beyond technical and economic feasibility.
- Diversifying the raw materials base is a central element of the chemical industry's raw material strategy. This includes the use of renewables.
- The chemical industry needs renewable raw materials at competitive world market prices. Existing trade obstacles should be reduced or eliminated.
- Further research and development efforts are required to open up new fields of application for the material use of renewables in the chemical industry. For research and market potentials to be utilised to the full, it is also essential to have an environment that is conducive to innovation and ready to accept new technologies.
- Innovation is a major lever for a broader material use of renewables. For this reason, actions by public administrations should give more focus on promoting research and development (R&D).
- The extent and the speed of new renewables-based products making their way depend on many factors: price, quality, properties, interest of customers, availability. Additional challenges arise where new value chains need to be built.
- Already now, new fields of application for the material use of renewables are a reality in the chemical industry. But from today's perspective, fossil raw materials will remain the most important component in the raw material mix of the chemical industry in Germany.

## Renewable raw materials in the chemical industry, as a part of the bioeconomy

The term „biomass“ comprises all materials of biological origin, excluding materials embedded in geological formations or transformed into fossil. Biomass either remains in the ecosystem or is used by humans as a raw material for food, energy generation or in the industrial manufacture of products (= material use). In this VCI paper, the term “renewable raw materials / renewables” stands for raw materials obtained from plant, animal or microbial biomass, which are used as materials in the chemical industry.

Under the German government’s National Policy Strategy on Bioeconomy of 2013, the concept of the bioeconomy “encompasses all sectors of the economy that produce, work and process, use, and trade with renewable resources, such as plants, animals, micro-organisms, and their derivatives.”

Already today, the material use of renewables is an important part of the bioeconomy. Renewable raw materials – such as vegetable oils, animal fats, starch, sugar or cellulose – have been established for a long time in the chemical industry. They have manifold fields of application, ranging from plastics and fibres, surfactants for detergents, cosmetics, paints and coatings, printing inks, adhesives, building products, hydraulic oils and lubricants to medicines. Overall, 2.7 million tonnes of renewable raw materials were used in 2013 by the chemical industry in Germany. This corresponds to a share of 13 percent in the total use of organic raw materials. The import share is ca. 60%.

Renewables are holding their own or are prevailing in applications where they bring technical, economic or other advantages over fossil raw materials in processing or use: By benefitting from the synthesis of nature or by taking new routes of synthesis, e.g. in biotechnology.

With the material use of renewables, the chemical industry can make contributions to a more bio-based economy and to a sustainable development. Basically, those raw materials which serve as a carbon source for chemistry are interchangeable. But this presupposes technical and economic feasibility as well as availability. Furthermore, this must not have negative effects on the performance and the sustainability of the application. Frequently, this combination of prerequisites is not yet given for renewables. Therefore, a broader raw material base is an important R&D goal of the chemical industry. In such efforts, the chemical industry can also contribute to the political goals of the Bioeconomy Strategy; in particular, to strengthening the innovation capability and the competitiveness of Germany as an industry location.

## Sustainability and resource efficiency as guiding principles

The chemical industry is committed to sustainability, regarding both the use of raw materials and production as such. The industry documents its responsibility for a sustainable development with sectoral and corporate initiatives like Chemie[3], Responsible Care and Together for Sustainability.

The chemical industry sees sustainability as the right balance between economic success, social responsibility and protecting the environment. When using raw materials, chemical companies focus on the highest possible resource efficiency – i.e. from the given overall perspective, the best possible solutions need to be developed for using raw materials as efficiently and economically as possible. Renewables have a key role in the pursuit of a broader raw material base, because they constitute the only renewable carbon source for material use in the chemical industry – beside the use of $CO_2$.

## USE COMPETITION FOR BIOMASS

There is strong competition between the uses of land available globally and also between the various use options for biomass themselves. The VCI has been highlighting this issue for a long time. The worldwide demand has risen significantly for biomass for use as an energy source, thereby triggering a discussion about sustainability which also touches upon the material use of renewables.

## SUSTAINABLE USE OF RENEWABLE RAW MATERIALS

Substituting fossil raw materials by renewables is not sustainable per se. Products based on renewables can be different from fossil-based products, both regarding their direct environmental impacts (energy consumption, greenhouse gas emissions) and their properties (e.g. utility value or recyclability at the end of their lifespan). Therefore, an overall approach needs to be taken in comparative analyses.

The fact that certain properties per se do not mean sustainability is illustrated, inter alia, by the example of biodegradability. Even though biodegradability is frequently mentioned in connection with renewables, biodegradability is a property independent of the raw material base. It is important for special fields of application for chemical products, e.g. for lubricants released into the environment or certain uses of plastics like, for example, mulch films. However, biodegradability is no one-fit-for-all solution, because quite often durability is the expressly desired product property. It is also worth noting that biodegradability is only possible under precisely defined conditions that are not always found in the environment. Consequently, biodegradability cannot solve the littering problem which exists in some regions of the world.

Comparative analyses across the entire lifecycle of the respective product are necessary for individual case decisions on whether using renewable raw materials is sustainable.

## SUSTAINABLE CULTIVATION OF RAW MATERIAL PLANTS

Another criterion for assessing the sustainability of renewables is the production of biomass on farmlands which cannot be expanded without limits. In particular, the cultivation of raw material plants must not be to the detriment of food and feed production. Furthermore, social impacts need to be taken into account, and it must be ensured that expansions of arable land do not destroy any ecosystems worth protecting. The chemical industry recognizes the significance of a sustainable biomass production also for renewables used as raw materials and has an active role in the

discussion, e.g. by participating in INRO (Initiative Sustainable Supply of Raw Materials for the Industrial Use of Biomass). INRO provides a framework for sustainability certification on a voluntary basis, which is put into practice by the companies under their own corporate sustainability strategies.

The best possible efficiency – i.e. using available arable land, raw materials and residues even more efficiently – is a major factor for the sustainable production of biomass. Chemistry makes decisive contributions to solutions, inter alia, with fertilizers, plant protection products and innovative crop varieties. When used responsibly, this modern form of agriculture provides high yields per unit area. This preserves ecologically valuable natural spaces like forests, moors and grasslands. Modern production methods are the best way for farmers to meet the challenges of a growing world population and the rising demand for plant raw materials. Such methods need to provide high yields while protecting the environment.

## Research, development and technology are key

Considerable further R&D efforts are necessary for expanding the use of renewables as materials in the chemical industry beyond existing fields of application. In order to fully utilise these research and market potentials for Germany and the EU, industry needs reliable framework conditions for chemical and biotechnological processes and markets; such framework conditions need to conform to the world market. Another important prerequisite is the acceptance of new technologies by all stakeholders.

### PROCESSING OF RENEWABLE RAW MATERIALS

Here, processing mainly aims for a complete utilisation of biomass by using all plant constituents and for an increased use of non-food biomass (inter alia, lignocellulose). This opens up new perspectives for the use of domestic renewables as materials.

Research and development efforts focus on improving efficiency, optimising the processing methods and developing new enzyme systems, sustainable catalytic synthesis routes as well as novel products. In this respect, industrial biotechnology is a key technology for an efficient conversion of biomass, alongside classic catalysis. In many fields, much more time and more investments are required to achieve economic viability through a high optimisation level of existing processes.

The position paper “Change in the raw materials base” takes detailed stock of the technical-scientific challenges and describes the need for research for the various raw materials. This paper of 2010 was elaborated by GDCh (German Chemical Society), DECHEMA (Society for Chemical Engineering and Biotechnology), DGMK (German Society for Petroleum and Coal Science and Technology) and the VCI.

### BIOREFINERIES

Biorefineries of the future are to enable the utilisation of all plant constituents for a large variety of products – by way of integrated processes. Depending on sufficient specifications, qualities and quantities, these products can be processed by the chemical industry. A considerable need for research remains across the entire value

chain before this can become commercially workable in practice. This is true, in particular, for the integration of different processes into coherent technical concepts, for the optimisation of processes and products and, not least, for upscaling from laboratory to industrial scale. Integration into existing value chains is an important success factor for biorefineries, e.g. synergies can be used at existing chemical sites. In order to drive forward the development of biorefineries, it is also necessary to promote demonstration projects on a technical scale. For a full analysis and description of the need for research, reference should be made to the Biorefineries Roadmap of the German federal government and to the status report of 2011 on the potentials of biorefineries by the VCI and DIB (German Association of Biotechnology Industries).

### PRODUCTION OF BIOMASS

An important action field for R&D is optimising the production of biomass. All technologies need to be used and further developed for achieving the highest possible yields in a resource-friendly manner, in particular green biotechnology. The latter enables better qualities, improved yields and the development of site-adapted plants, thus contributing to a sustainable biomass production.

### STRENGTHENING RESEARCH & DEVELOPMENT

Innovation is a prerequisite and, at the same time, the major lever for a broader use of renewable raw materials. Therefore, actions by public administrations should give emphasis on a stronger and more focused support for R&D. This applies equally to basic research at universities and institutes and to corporate research and development into new processes, technologies and products, which should continue to be supported with adequate project funding. In addition, the VCI advocates fiscal incentives for research.

## Market instead of regulation

German chemical companies are engaged in international competition in a free market. The chemical industry supports efforts to strengthen a sustainable and competitive use of renewable raw materials. More economic viability (for diversifying the raw material base in existing value chains and products) and/or technical breakthroughs (for new value chains and uses) are essential for renewables to succeed in further applications. However, proposals for steering the use of renewable raw materials – by means of fiscal or economic instruments – should be seen a critical light, for the following reasons:

### POLITICAL TARGETS OR QUOTAS

Insufficient data exist for potential, politically motivated targets for the use of renewables that might be taken as a basis for regulatory instruments. Moreover, such targets do not work in a free market where experience shows that customer decisions are not oriented to political targets or quotas. Products are purchased, because they fulfil a given function while convincing customers in terms of quality and price.

## SUBSIDIES OR TAXATION

The chemical industry rejects subsidies for the use of renewable raw materials, and this is not only for regulatory reasons: subsidies could not overcome the manifold shortcomings in R&D. Quite the contrary, subsidies would to a considerable extent result in windfall profits for already existing volumes. Even if new fields of application could be created artificially by way of subsidies, most of them would be unlikely to hold their own in competition or with a perspective subsidy phase-out. Instead of introducing new subsidies for the material use of renewables, subsidisation should be reduced for the energetic use of biomass – aiming to bring about the prerequisite equality in competition for the various types of uses for biomass. Taxation on fossil raw materials in Germany or Europe would be even less suitable to drive forward the use of renewables. The cost burden would restrict the ability of chemical companies to develop new fields of application for renewable resources and significantly weaken their international competitiveness.

By contrast, reducing or eliminating trade barriers and market distortions is a much more promising approach:

## IMPORTING RENEWABLE RAW MATERIALS AT WORLD MARKET PRICES

Currently about 60 percent of renewables for material use in Germany are imported. According to estimates, the potential is limited for further expanding the agricultural areas for biomass. In a global comparison, this potential is mostly given outside Germany. Against this backdrop, the chemical industry will continue to depend on imported renewables also in the future. This makes it so much more important to reduce or eliminate – within agricultural policies –existing trade barriers for renewables used for industrial purposes, in order to ensure supplies of raw materials to the chemical industry in the required quantities and at competitive world market prices.

## ELIMINATING TRADE BARRIERS IN THIRD COUNTRIES

The trade barriers of third countries distort raw material markets too; this is to the detriment of the use of renewables. Export duties or export quotas for renewable raw materials make their use more costly in the importing countries; here, palm oil is a good example. Therefore, the EU – possibly jointly with allies – should strive to limit both types of interventions in the future. This could be done under the WTO regime or in bilateral trade agreements.

## Perspectives

Unlike in the early days of promotion for renewables, the focus is no longer on generating sales opportunities for surplus biomass. Now the challenge is to use biomass – which is available only within limitations – as efficiently as possible. In this setting, the use as food and feedstuff has always priority. Sound and acceptable compromises and concepts need to be elaborated to balance food production and the material use of biomass with each other. The goal should be one overarching and integrated strategy for the use of biomass, oriented to the principle of resource efficiency. This applies to both the competition between the various use paths and the use of regionally available biomass – and also to the further development of renewable alternatives which are not part of the competition between uses and for land, such as photovoltaic and wind power. Here, the German federal government's National Policy Strategy on Bioeconomy of 2013 goes in the right direction.

The market can distribute scarce goods more efficiently than government regulation. Therefore, a market-based development should be given priority when expanding the use of biomass. The chemical industry contributes to the bioeconomy: with the use of renewables as materials and, in particular, with research and development into new possibilities for application. But the orientation to the market also means that renewables-based products are not self-sellers – prices, qualities, availability, properties and customer interest are decisive for the demand. For entirely novel applications and products, the need arises not only to open up new markets but also to build perfectly new value chains in interaction with various players. These challenges, which used to be underestimated in the past, are among the reasons why developments in many fields have not been quite as dynamic as had been hoped.

From the technological perspective, further major R&D efforts are needed to open up new fields of application for renewables. The chemical industry actively works on broadening its raw material base and increasingly uses renewables where this is technically feasible and makes sense from economic, ecological and social aspects.

Policy makers should create favourable framework conditions, support the necessary R&D activities and technology acceptance and should also aim to eliminate the competitive disadvantages for imports of renewable raw materials. Instead of introducing new subsidies for the use of renewables as materials, support for the energetic use of biomass should be reduced in order to create a level playing field for the various types of uses for biomass.

## Further reading:

- Fakten zur Verwendung von Palm(kern)ölen in Wasch-, Pflege- und Reinigungsmitteln in Deutschland (Facts on the use of palm (kernel) oils in detergents, cleaning and maintenance products in Germany), Forum Waschen, 2013
- Forschungs- und technologiepolitische Empfehlungen der chemischen und biotechnischen Industrie zur Ressourceneffizienz und zur Rohstoffbasis im Wandel (Research and technology policy recommendations by the chemical and biotechnology industry, regarding resource efficiency and the changing raw material base), VCI and DIB (February 2014)
- Leitlinien zur Nachhaltigkeit für die chemische Industrie in Deutschland (available in English language: Sustainability guidelines for the chemical industry in Germany), Chemie$^3$, initiative of VCI, IG BCE and BAVC (2012)
- Marktanalyse Nachwachsende Rohstoffe (Market analysis renewable resources), FNR (2014)
- Nachwachsende Rohstoffe für die chemische Industrie: Optionen und Potenziale für die Zukunft (Renewable raw materials for the chemical industry: options and potentials for the future), study by the IFEU Institute for Energy and Environmental Research (Heidelberg, 2007) – Summary and conclusions by the VCI
- Nationale Politikstrategie Bioökonomie (available in English language: National Policy Strategy on Bioeconomy), German federal government (2013)
- Roadmap Bioraffinerien (available in English language: Biorefineries Roadmap), German federal government (2012)
- Rohstoffbasis im Wandel (Change in the raw material base), position paper by DECHEMA, GDCh, VCI and DGMK (2010)
- Statusbericht zu möglichen Potentialen von Bioraffinerien (status report on conceivable potentials of biorefineries), VCI and DIB (2011)
- Sustainability of Products – What it's all about, Cefic publication (2012)
- Together for Sustainability, joint initiative of chemical companies

Contact at VCI: Tilman Benzing
Phone: +49 (69) 2556-1414
E-Mail: tbenzing@vci.de

Verband der Chemischen Industrie e.V.
German Chemical Industry Association
Mainzer Landstraße 55, 60329 Frankfurt