Food & Biobased Research

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UNIVERSITY & RESEARCH

Healthy and sustainable choices: now and in the future

The world around us is changing rapidly. Raw materials are becoming scarce, greenhouse gases affect our climate and health problems occur due to overweight and malnutrition. Prosperity does bring progress, but it also brings new issues that need new solutions. Finding these solutions means combining in-depth knowledge, game-changing innovation and scientific expertise translated to practical applications. Researchers at Wageningen Food & Biobased Research tackle these complex issues supported by a firm understanding of the working practice.

Wageningen Food & Biobased Research is a contract research organisation that develops insights and technologies that support industries, governments and consumers to make the right choices and to innovate responsibly and effectively. Our in-depth knowledge of the entire chain, from raw materials through processing to end product, drives our approach. We partner in the creation and production of healthy and tasty foods, of truly-sustainable food chains, and in developing chemicals and materials that use biomass instead of fossil resources.

Driven by a perceptive, knowledge-based curiosity, our multidisciplinary researchers, from diverse yet complementary backgrounds, approach problems with scientific rigor and creativity. Working closely together, we solve complex questions through a combination of intelligent analysis and pragmatic invention. Grounded in science and business, our researchers bring a no-nonsense attitude to their work.

Fresh, healthy and delicious

We see opportunities for improvement throughout the entire food chain, from raw material to end product and from producer to consumer. The better we can control the quality and shelf life of fresh food, for example, the less waste there will be. That is why our clients engage us to help them produce, transport and preserve fresh food products in more efficient and smarter ways. Getting fresher foods to the consumer is just one of our focus areas. For example, we work on personalised nutrition concepts and also research the health effects of nutrition: developing protein-rich meals that help prevent malnutrition in the elderly. We improve foods, making them healthier without compromising the features that make them so appealing to the consumer: delicious soups with reduced salt levels and tasty, attractive goat's cheese with reduced fat content.

Circular Economy

Together with our customers, we develop production processes and biobased materials that will transform the current economy into a Circular & Biobased Economy. With our innovative technologies, we turn side streams and residues from the food industry, agriculture and natural infrastructure into marketable products: foods, feed, chemicals, materials, fuels and energy. Our research helps clients to launch competitive, innovative products made from renewable raw materials. Using our understanding of the application of chemistry and biotechnological processes to the conversion of biobased resources, we produce new chemicals and develop innovative materials that are strong, sustainable and marketable. Materials such as resins and coatings but also composites and bioplastics for the packaging, automotive and electronics industries.

Smart connections

Wageningen University & Research's mission – *to explore the potential of nature to improve the quality of life* – gives meaning and direction to the activities of Wageningen Food & Biobased Research. Our researchers have direct access to the latest scientific findings and have a firm grasp of what modern technology offers.

Making smart connections between various disciplines, we investigate and develop at all stages: upscaling from lab to pilot and from initial idea to the production processes that deliver real products for our customers. To fulfill our promise, we ensure that the solutions we create are applicable in daily practice. Every day, we work with national and global companies, government authorities and other research institutes to create innovative solutions for a healthier, more sustainable and prosperous world; now and in the future.

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The infinite possibilities of sugar

Companies in the agrifood industry seek added value for biomass streams containing high levels of sugars, with the abolition of the sugar quota by the EU in 2017 playing a major role. At the same time, the processing of sugars in food products is under severe pressure: excessive sugar intake can lead to 'prosperity diseases' such as obesity, diabetes and cardiovascular illness. This in turn creates a market for new high-quality applications from carbohydrate-rich raw material streams.

Sugar beet pulp is an example of a carbohydrate-rich biomass stream that could generate a great deal more value. A tonne of sugar beet pulp now yields companies 150 euros, while Wageningen scientists believe it could generate 20 to 50 times more. Wageningen Food & Biobased Research is working with industry to develop valuable new products from carbohydrate-rich residual streams, such as sugar beet pulp and the sugar beet itself. Commercially interesting applications are within reach: from bioplastics, additives in adhesives and resins to building blocks for chemicals.

Large and small companies

Wageningen Food & Biobased Research mainly focus on biorefinery and the conversion into valuable ingredients from biomass. We work with both major companies, such as Cosun and ADM, and smaller players. "From fractionation to separation and conversion: mechanical, by means of enzymes or by mild use of acids and alkalis, we excel at biorefinery," says Gulden Yilmaz, programme manager Biorefinery. "Our approach is tailor-made, matching the desired requirements. By using the right biorefinery-technologies, we can ensure that carbohydrate containing fractions are separated and converted into valuable components. Sometimes extra conversion steps are necessary to add the desired properties. In this way, we convert carbohydrate containing sidestreams into a wide range of biobased building blocks for products, something which is of considerable interest to companies."

High-quality cellulose fibres

Making the best possible use of the unique properties of ingredients is the challenge, according to Jacco Van Haveren, programme manager Biobased Chemicals. It is also the motivation behind the many years of cooperation with raw material producer Cosun. “Cosun developed a new biorefinery process to produce high-quality cellulose fibres from sugar beet pulp, for instance,” Van Haveren explains. “While this fibre could also be extracted from woody biomass streams, this would require more energy and, significantly, considerably more chemical additives. We analyse these cellulose fibres and study their suitability as a raw material for dozens of products, from concrete and drilling fluid to paint.”

Glucose-based molecules

Together with raw materials producer Archer Daniels Midland (ADM), we are working on the production of glucose-based molecules as a basis for products such as bioplastics. Van Haveren: “We are focusing on bioplastics that are resistant to high temperatures – a condition for many applications. Although it is possible to produce a high-quality biobased soda bottle using polylactic acid, once heated to temperatures above 50 degrees Celsius it softens. We believe it is technologically and economically feasible to make products from carbohydrates that are stable at temperatures over 400 degrees while remaining transparent. An example is a coffee cup that is as heat-proof as existing petroleum-based cups. This can be achieved by converting carbohydrates via various steps into polymers which provide the product with exactly the desired properties.”

‘We can convert carbohydrates into a wide range of biobased building blocks for products’

Competing with ‘fossil’ chains

From biobased plastics and coatings to paints, resins, adhesives and additives for chemicals; the application possibilities for sugars are infinite. “We want to find the right uses for carbohydrate-rich biomass streams but also work ‘the other way around’,” Van Haveren concludes. “We bring the right partners together and develop new value chains that can compete with existing ‘fossil’ chains. As a result, the biobased economy is gradually gaining ground. Moreover, a better utilisation of these streams does not affect the sugar production for food.”

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Agrologistics: key component of economic growth

How to ensure food security throughout the country is an issue challenging the governments of most emerging economies. Wageningen Food & Biobased Research supports them to develop modern strategies that improve their agrologistics systems, benefitting employers, workers, consumers and their economies.

Wherever you look, whether it's Mexico, India or Africa, wealth is increasing, matched by consumer demand for high-quality food products. National authorities must ensure optimal supply of a wide range of vegetables, fruits, meat, dairy and other fresh produce, in every part of their land. Most know this requires efficient agrologistics, but how to build an effective system? "Often there are so many issues to be tackled, that governments do not know where to start", explains Peter Ravensbergen, business development manager. "Should you begin with infrastructure, modern cold stores or advanced computer systems?"

Wageningen Food & Biobased Research helps governments develop well-considered, hands-on strategies to improve fresh logistics, education and (post-harvest) technology in their countries – thereby addressing the entire agrologistics system. "This substantially improves food quality and safety in each country, boosting local employment, domestic trade and exports", stresses Ravensbergen. "An effective agrologistics system also reduces costs and food waste."

Integrated approach

We have an unique a unique, comprehensive approach to agrologistics, where specialists from various disciplines collaborate to achieve agreed goals. "In close consultation with experts and local stakeholders we develop a well thought-out, long-term plan with concrete actions, costs and benefits. The plan also identifies opportunities for public-private partnerships and supply-chain collaborations", says Ravensbergen. "Governments can immediately begin implementation."

Over the past 20 years we have supported governments around the world in improving their national agrologistics. "For the Mexican government we developed 15 concrete policy steps, which were implemented in close collaboration with research organisations and business, that have substantially improved Mexico's agrologistics", illustrates Ravensbergen. The Wageningen experts mapped opportunities and challenges for the agrifood sector, organised workshops for stakeholders and translated the outcomes into an action plan that was supported by every party involved. Wageningen Food & Biobased Research also worked, with the Argentinian government on the export of fresh fruit and vegetables to Europe.

'Agrologistics substantially improves food quality and safety in each country, boosting local employment, domestic trade and exports'

Strengthening local economies

Ravensbergen believes that having a solid agrologistics policy will become more important in the coming years. "Around the world, governments of emerging countries realise they cannot invest only in increasing crop yields; they must establish effective post-harvest supply chains", he says. "These add value to their fresh produce and strengthen their local economies. In Wageningen, we have the knowledge and expertise they need."

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Automated, robotics quality control brings global savings

Worldwide, fresh-produce robotics is booming, offering industry substantial time and cost savings. An exciting innovation is Wageningen Food & Biobased Research's advanced Quality Phenomics Robot for measuring the quality of fruit and vegetables.

The robot, developed as part of the GreenCHAINge project and based on the technology of high-speed sorting systems, is able to test a variety of external and internal quality factors, non-invasively, such as dry-matter content, firmness and sweetness. Although it mimics a human quality-expert, it combines more-objective and reliable data with much higher capacity.

Precise and efficient

A robot is precise, efficient, consistent and never needs a break. "Due to time and labour constraints, human assessors usually check only a few samples from thousands of items, using sight, smell, taste and a limited set of sensor tools", says Rick van de Zedde, business development manager Computer Vision. "Using relatively incomplete data they must decide whether a whole shipment of fruits and vegetables meets the quality criteria." The current quality assessment procedure already wastes food because of destructive tests, and in the logistic chain, food and therefore money is wasted because quality development is not fully understood and this often leads to excessive amounts of usable fresh produce being rejected.

"According to the UN Food and Agriculture Organization, an estimated 40-50% of root crops, fruit and vegetables are lost", stresses Van de Zedde. "Better measurement of quality throughout the logistic chain, via automated control of the internal and external quality of products, could substantially reduce these losses."

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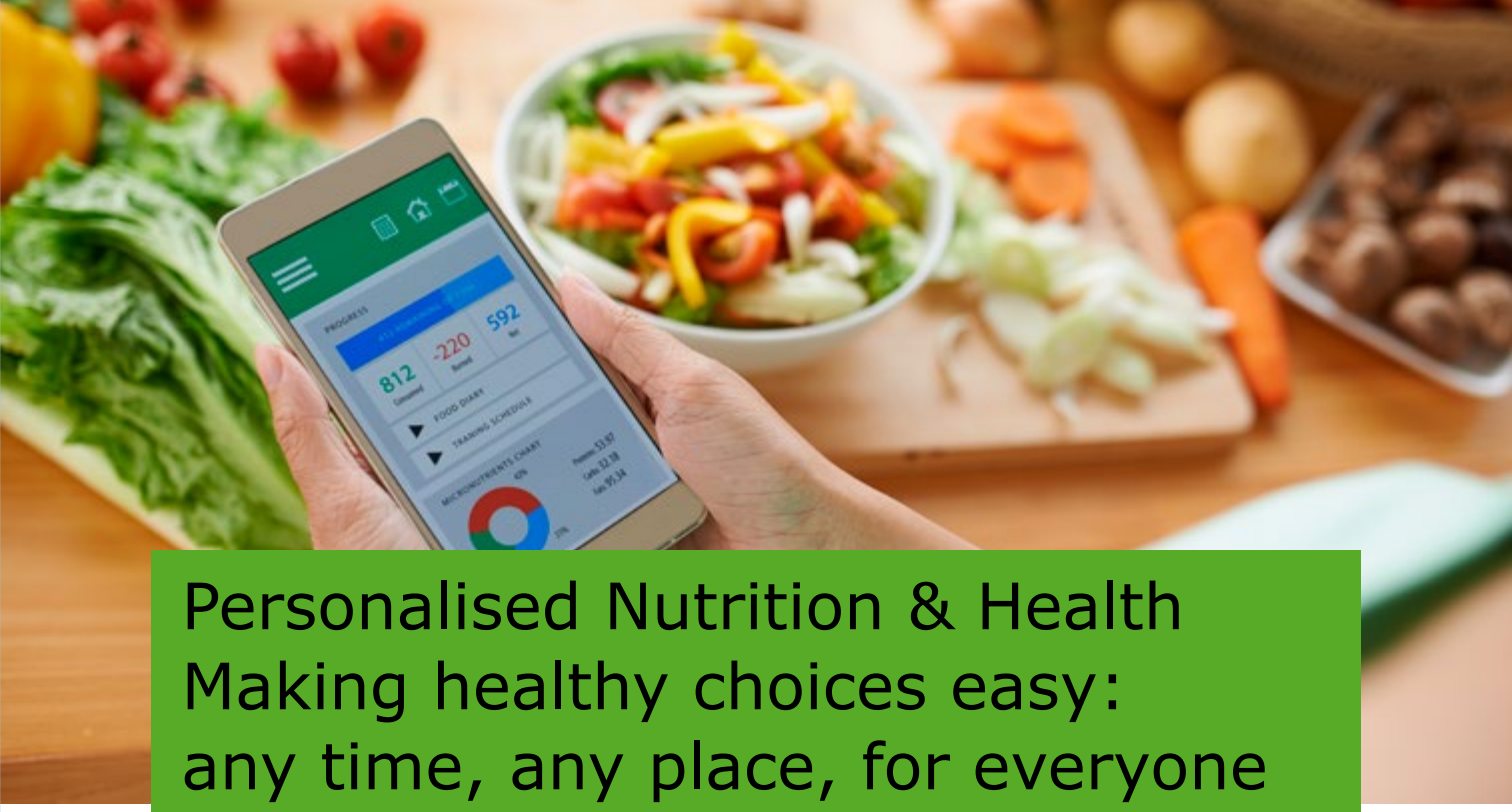

Personalised Nutrition & Health Making healthy choices easy: any time, any place, for everyone

A population motivated by tailor-made, personalised advice that follows precise, individual diet and lifestyle guidelines. This future scenario comes promisingly nearer with the establishment of the public-private partnership *Personalised Nutrition & Health.*

Emma needs to increase her energy intake, whereas Harry would benefit from calorie restriction. And where Emma runs ten miles for fun, Harry has to be motivated to go the gym. Personalised nutrition and health advice helps people make healthy choices that precisely meet their personal needs. This increases the chance that people will adopt and maintain healthy behaviours, combatting, for example, overweight and diabetes.

Personalised advice

Personalised Nutrition & Health consortium – initiated by TNO and Wageningen University & Research in April 2016 – will identify the technology and knowledge needed to make personalised food and health advice possible on a large scale. "Consortium partners can develop innovative services such as tailor-made shopping lists and meal boxes, or apps for do-it-yourself (DIY)-monitoring", illustrates Liesbeth Luijendijk, business development manager Food Informatics.

Unique approach

The consortium uses a globally unique approach in which various disciplines work together: from life and consumer sciences, to data-analysis and sensor technology. Issues studied include methods for DIY measurement of food intake and health, the translation of these insights into personalised advice, and consumer behaviour research.

Luijendijk expects that, within two years, the consortium partners will be able to add value to their businesses. "This will simultaneously boost further innovation and will bring us closer to our ideal of a healthy, self-regulating society."

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Today’s waste is tomorrow’s profit

Getting the maximum out of agri-food side streams is key to the food circular economy. Wageningen Food & Biobased Research supports value chain partners in this field to valorise side streams in an optimal way, creating value added products for many applications, making a strong and significant contribution to the circular economy.

How can I obtain higher value for my side streams and thereby contribute to the circular economy? is a question concerning many businesses. A circular economy reuses resources and products efficiently and effectively, maintaining raw materials’ value. Vital as populations increase and resources become scarcer.

“The opportunities to better use these resources in its full potential in high-value applications via a sustainable cycle are huge. Currently, the majority of agrifood side streams is valorised as feed, fermented for energy production or even incinerated”, stresses Toine Timmermans, programme manager Sustainable Food Chains. “Companies wanting to get the maximum out of their side streams in the best possible way want to know about the best options and what it might return.”

Maximum value extraction

Wageningen Food & Biobased Research helps partners to extract maximum value from side streams. “We provide expert services like product and process development, food and feed safety control, consumer research and supply-chain design and establishing new collaborations and business models, at every step needed to transform ideas into marketable products.”

Specialists from different fields, such as pre-treatment and separation technology, fermentation, biotechnology, structuring and chemical modification, collaborate closely, "allowing us to support partners, throughout the chain, to process side streams into value-added ingredients and products", says Timmermans.

Linking food and non-food

Unique to the organisation's approach is the combination of food and non-food related approaches and disciplines. "In the cultivation of food crops and production of food products there will always be a part that is unfit for human consumption", explains Gülden Yilmaz, programme manager Biorefinery. "Side streams like plant stems, leaves, fruit and vegetable skins and (fish) bones or streams from processing can become sustainable raw-material sources for biobased (non-food) products, providing environmental benefits while adding value."

We initiate and support many innovative projects focussing on optimum valorisation of side streams. In the Pulp2Value project specialists are part of a 12-company team exploring new applications for sugar-beet pulp fibres. "These include ingredients for detergents, personal care products, paints, coatings and high-performance plastics", explains Yilmaz.

In the CARVE project experts examine whether consumers enjoy cookies and ginger cake made from unsold bread. Noteworthy, too, are studies conducted in partnership with De Verspillingsfabriek (The Waste Factory), producing a series of food products from surplus foods.

Chain-wide collaboration

We are convinced that circular economy is only achievable via a multidisciplinary approach and chain-wide cooperation. "This is why, in the last few years, we have brought together many partners in projects and consortia, including the European project *REFRESH, The Source Shakers and the Dutch TaskForce Circular Economy in Food"*, says Timmermans.
"Our ambition is to contribute to cutting the global food losses and waste in half, by transforming agrifood-side streams into value added food, feed or biobased products", stresses Yilmaz. "This means that raw materials will be used more efficiently and effectively, delivering a positive impact on resource use efficiency, social returns and the environment. Moreover a positive economic impact can be expected due to increased value creation by existing companies and new businesses."

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'Our ambition is to contribute to cutting the global food losses and waste in half'

Developing sustainable tasty meat analogues with a bite

Creating meat analogues with the appearance, taste and texture of steak is now possible using the innovative shear-cell technology of Wageningen University & Research. A public-private partnership has been established to bring new meat analogues to the market.

By 2050, population growth and increased prosperity will double the global demand for meat, putting a huge burden on the planet. Shear-cell technology mimics the characteristics of meat, by precisely regulating the formation and length of fibres created from alternative proteins. "It is a milder alternative to conventional extrusion processes", says Atze-Jan van der Goot, professor at Wageningen University & Research and inventor of the technique. "Raw materials are gently kneaded, preserving protein functionality and keeping energy expenditure low."

Companies representing the whole production chain – from ingredient supplier to machinery manufacturer – participate to the public-private partnership, with the aim to step up from pilot project to full production.

"We are working to develop different 'meat' structures – pork, beef, chicken and fish – utilising different protein sources; soy, pea and lupine, at various levels of purification", illustrates Van der Goot. "The less purified the source, the greater the sustainability benefits."

Marjolein van der Glas, business development manager, expects shear-cell technology will have a great impact on the meat analogue market. "Within five years there will be a whole range of tasty new products on the supermarket shelves, in restaurants and even in pet food; innovations that will add variety and sustainability to this market."

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Biobased Performance Materials: plastics, resins, coatings and glues from plants

The Biobased Performance Materials (BPM) research programme aims to develop high-quality materials based on biomass: sustainable materials such as bioplastics for which there is an increasing market demand.

The BPM programme connects knowledge institutes and companies that are focused on two types of polymer materials: polymers produced by and extracted from plants, and polymers made from biobased building blocks produced via biotechnology or chemical catalysis.

"BPM has already produced several new biobased materials," comments Christiaan Bolck, programme manager Materials and director of the BPM. "Examples include new biobased coatings and industrial glues, and stronger lactic acid-based plastics. We are currently looking into the development of biobased bitumen and injection moulding of plastics from succinic acid. The properties of new biobased materials are encouraging companies to start looking at wider, more robust applications. Biobased materials can be used to make so much more than disposables alone, including high-end products."

The success of the BPM programme is due in part to the emphasis on deploying all available technologies to make new materials and new applications. "Five to ten years ago, many biobased-related research projects were still focused on the first part of the value chain and only using one type of technology, such as biotechnology to create a biobased building block," explains Bolck. "This stopped development of the product from going any further in the value chain. Thanks to BPM, the focus has been extended to the end of the value chain: from building blocks to final product."

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Fully sustainable packaging in the circular economy

The transition to a circular economy requires new, sustainable packaging concepts. At the same time, the notion of sustainability raises questions for companies that make and use these packages: What are the properties of the resources and materials used for such packaging?

Does it guarantee the shelf life of the packaged product? Can it be recycled properly? And what drives consumers to reach for sustainably packaged products on the shelf? Wageningen Food & Biobased Research looks at the entire packaging cycle, from raw material to recycling. We develop packaging concepts that are genuinely sustainable while maintaining their function throughout the cycle.

Natural building blocks with novel properties

The properties of natural raw materials such as agricultural residues, and the channels through which raw materials are transformed into components, are well known to Wageningen Food & Biobased Research. “With the help of polymer chemistry and biotechnology, we can make all kinds of alternatives to traditional packaging from natural materials such as potatoes and corn residues or plant stems,” says Christiaan Bolck, programme manager Materials. “We use biobased building blocks, such as starch, polylactic acid, furandicarboxylic acid and succinic acid. Each of these materials gives a particular set of qualities to the packaging.

Electronics must have antistatic and shockproof packaging. Produce packaging needs to 'breathe', while meat and fish require the opposite: gas-tight wrapping. In addition, there is a great demand for containers that are recyclable and/or biodegradable. We search for the best packaging material based on market requirements."

Impact of packaging on consumer choice

The research taking place in Wageningen into the impact of packaging on consumer choices is also valuable to market participants. A good example is a research programme we conducted in cooperation with Wageningen Economic Research and a number of top brand manufacturers. "The aim is to know the qualities that biobased packaging should have in order to encourage consumers to reach for it on the shelf," Bolck states. "Are consumers sensitive to biobased labels on the packaging? Should it feature visible natural fibres? Or does the new packaging instead need to look exactly the same as the old? Answers to these kinds of questions let us examine whether it is possible to produce more attractive packages at reasonable cost."

Logistics demands on packaging

Logistics plays an important role in how packaging works, according to Matthijs Montsma, business development manager Postharvest Technologies. "The way a product is transported determines the requirements with which packaging must comply and the associated costs. For instance, the transport of bananas in a shipping container must allow for efficient loading and proper protection against pressure, desiccation and premature ripening. Solving these issues is our area of expertise."

The selection of packaging is more and more dependent on sustainability, Montsma points out. "Crates of chemically treated tropical hardwood in which potted plants from Central America were transported used to be hauled off as chemical waste immediately upon arrival in the Netherlands. Now we have developed alternative steel crates that are suitable for reuse and can be loaded more efficiently, with fewer harmful emissions as a result."

From waste back into raw materials

Stimulating the reuse of plastic, glass and drink cartons requires improvements in a number of links in the waste chain. "We have shown that recycling drink cartons is technically feasible in the Netherlands," Bolck says. "Many market players had previously estimated that this would be too technically complicated. We also examined how the recycling rates of glass and plastic containers could be increased further. These are complex issues as many parties are involved. Our work across the chain enables us to bring stakeholders together and jointly look for solutions."

Christiaan Bolck sees this study as a source of interesting opportunities for the beginning of the packaging cycle. "Effective separation at source and after use, followed by near-infrared sorting, enables us to isolate raw materials from packaging waste, and use them to produce new packaging. This closes the circle, to everyone's benefit."

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Fatty acids on demand thanks to microbiology

Fatty acids are a valuable alternative to palm and coconut oil. The production of these oils – the main component in a variety of food products, materials and chemicals – is however linked to social issues such as large-scale deforestation to clear space for plantations.

In our search for sustainable alternatives, Wageningen Food & Biobased Research scientists focus on micro-organisms such as algae, yeasts and bacteria. These organisms can convert low-cost and sustainable organic raw materials into valuable fatty acids in a cost-efficient way.

The global demand for fatty acids is growing rapidly. We are studying which residual streams can be cost-efficiently converted into fatty acids for the production of biobased materials and chemicals or into healthy fats for food products with the aid of micro-organisms.

Fatty acids on demand: C12, C14 and C16

Algae, fungi, yeasts and bacteria excel at producing saturated fatty acids such as C12, C14 and C16 from plant material as well as common unsaturated fatty acids such as C18, C20 and C22. According to fermentation expert Jeroen Hugenholtz they each use their own methods via various fermentation routes. "It is interesting to see that these routes can be adapted in such a way via strain and process improvements that they produce exactly the right fatty acid. We now know how many micro-organisms produce the desired fatty acids. Some routes can be very expensive or energy-inefficient. By properly comparing the various routes and taking the wishes of the client into account, we can make the right choices. While a microbiological route may be preferable for one application, another may be more suited to a chemical route or a route using microalgae."

Microalgae

Microalgae produce fatty acids in an efficient way. We are studying the entire production chain of microalgae: from cultivation to end product. Via fundamental research, the scientists are unravelling the biology of algae: how exactly do these micro-factories produce

'It is interesting to see that micro-organisms can produce exactly the right fatty acid'

valuable oils and fatty acids? How do we find the best route for unlocking these components via biorefinery in a cost-efficient way? Together with Total and Unilever, for example, a future production chain for algae oil as an alternative to biodiesel and traditional edible oils is being examined.

Yeasts, fungi and bacteria

Yeasts and fungi can also be used for the production of fatty acids 'on demand'. We have proven that it is possible to influence the saturation level of fatty acids by switching on or off microbiological processes of the yeast variety Cryptococcus. Bacteria have been shown to be suitable for this type of 'manipulation' and current research is looking into the Pseudomonas bacterium. "This bacterium is mainly known as an efficient producer of the bioplastic PHA," says Hugenholtz. "If desired, however, it can also directly produce hydroxy fatty acids which are a part thereof. PHA is suitable for applications such as packaging material, agricultural and horticultural products, coatings and medical products."

Major breakthrough only a matter of time

As the routes to new fatty acids become gradually clearer a major breakthrough is only a matter of time Hugenholtz predicts. "Niche markets are already using fatty acids based on micro-organisms. Developments may accelerate once regulations for food products allow the use of more fatty acids via microbiological routes. Methods such as CRISPR/Cas9 enable genetic changes in organisms without inserting foreign DNA, without the use of GMOs. This brings the large-scale production of fatty acids using micro-organisms much closer."

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Insights into how dietary fibres affect the human immune system

Could dietary fibres support the immune system and improve resistance to flu? This is one of the issues studied in the EC-funded research programme FibeBiotics, initiated and coordinated by Wageningen Food & Biobased Research.

The research has provided scientific insight and tools that shorten time to market of fibre-enriched products that can strengthen the immune system and prevent some common health problems.

From the reduction of cholesterol levels to the improvement of bowel: dietary fibres are becoming the 'go to' ingredient for their wide-ranging health benefits. National and international authorities have increased the recommended daily intake (RDI) levels of fibre in their nutrition guidelines, while consumer awareness of the benefits of fibre-rich foods is on the increase. "The benefits of dietary fibres on bowel function and cholesterol levels, in humans, are generally accepted", says Jurriaan Mes, expert leader Food Quality & Health Effects. "However, when it comes to their effects on the immune system – which is involved in almost every facet of human health – much less is known."

Broad approach

Wageningen Food & Biobased Research initiated and coordinated the FibeBiotics programme (www.fibebiotics.eu, 2012-2016) to deepen the understanding of this issue. “Our aim was to reveal the working mechanisms and indemnify what models would be best to study and predict the effects of fibres on the immune system, in order to facilitate the development of beneficial fibre-enriched food products”, explains Mes.

The research, in which 17 partners from across Europe worked closely together, took a uniquely broad approach, investigating a wide range of dietary fibres and fibre combinations. Biochemical analyses were carried out, as well as digestion and fermentation studies, using different in-house developed in-vitro models. The programme also included a placebo-controlled clinical trial to compare the effects of different dietary fibres on the efficacy of a standard flu vaccination in people 55+ of age – a measure for improving the immune system. “The studies were compliant with current EFSA criteria for biomarkers use.”

Reference framework

FibeBiotics has identified many valuable mechanistic insights into how dietary fibres affect the human immune system. “Moreover, testing so many different fibres has provided us with a reference framework for the characterization of current and new fibres of interest”, stresses Mes. “This will facilitate faster screening, and will provide new leads for product development.”

The study outcomes indicate that some dietary fibres indeed could be beneficial for the immune system; effects that will need to be confirmed in larger trials in order to prove causality. “If companies set up such trials, products with solid immune-system-supporting health claims could be within reach in only three to four years”, says Marloes Groenewegen, programme manager Healthy and Tasty Food. “We are ready to support them in all aspects of the development process, from early screening to the compilation of dossiers for the European Food Safety Authority (EFSA) and the development of products, product labels and marketing communication strategies at a later stage.”

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Proteins and health

Wageningen Food & Biobased Research investigates the health effects of proteins, using models similar to those used in fibre research. The research focusses on the development of tools for rapid, efficient screening, nutritional value and bioavailability and the prediction of health effects. Topics of interest include allergenicity, anti-nutritional effects, protein synthesis in muscle tissue and, again, immune effects.

Blueprint for regional biobased economy opportunities

The northern Netherlands has favourable prospects for a strong biobased economy. Excellent seaports, a strong chemicals & plastics sector and an abundance of raw materials combine to strengthen the position of the region as a large-scale producer and supplier of renewable raw materials and products.

Wageningen Food & Biobased Research developed a blueprint for the biobased economy in the northern Netherlands, with concrete opportunities for new product chains, including regional production of green chemicals, plastics and animal feed protein.

The scientists conducting the study looked specifically at ways to link opportunities in the agricultural sector, a major sector in the northern Netherlands, with the existing chemical and plastics infrastructure in Delfzijl and Emmen. "We based this research on three economic pillars that are important for the biobased economy: molecules from biomass, materials from biomass, and protein for animal feed," says Harriëtte Bos, senior scientist and co-author of the Noord4Bio study.

The northern Netherlands has a remarkable combination of strengths: high-quality seaports, prominent chemicals and plastics cluster, strong arable farming sector and plenty of room for livestock farming, including the potential to expand. But the region is also facing challenges: the existing chemical clusters in Delfzijl and Emmen are facing a decrease in economic activity and are losing people and talent every year.

"To capitalise on the opportunities we see, we need to mobilise enough companies who are willing to seize the opportunities," says Bos. "These companies will be able to pool resources, set priorities and implement plans with the help of networks such as the Eemsdelta, Greenlincs and GreenPAC." Close partnerships with the German Weser-Ems area could boost the supply of 'home-grown' biomass raw materials, enabling the northern Netherlands to develop into a world-class player.

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Working with Wageningen Food & Biobased Research

Wageningen Food & Biobased Research develops knowledge and technologies that help companies, government authorities and other research organisations create innovative solutions for a healthier, sustainable and prosperous world.

We help clients worldwide to develop healthy and tasty food, sustainable food chains and 'green' alternatives for products currently produced from scarce fossil resources. Our clients value us for our focus on finding solutions, our knowledge level and the quality of our research.

Would you also like to team up with Wageningen Food & Biobased Research? You can: as a Contract Research Organisation, we provide the knowledge and solutions necessary to meet the wishes and demands of your target groups. We work with companies individually (bilateral), or with various organisations at the same time (public-private partnerships). Confidentiality and appropriate agreements on intellectual property (IP) form the basis for our relationships.

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