Chemical Reuse, Recovery and Recycling in Textile Factories

Promotion of Sustainability in the Textile and Garment Industry in Asia-FABRIC

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FABRIC Asia

8. Advancing to Circularity

12.00 – 13:00

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on behalf of GIZ FABRICS and Espire Consult

Agenda

- The session will give an overview about the actual state of the art of chemicals recovery, recycling and reuse in the textile finishing sector. Opportunities and limitations will be adressesd.
- The option of chemical leasing will be presented and factors which have to be considered for non-linear use models (circularity model)
- After the presentation the participants are requested to share their experiences and possible future activities to implement aspects of circular chemical management in the textile value chain.

Agenda

Recovery Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy (Waste Directive (2008/98/EC)).

Recycling Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations (Waste Directive (2008/98/EC)).

Reuse Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived (Waste Directive (2008/98/EC)).

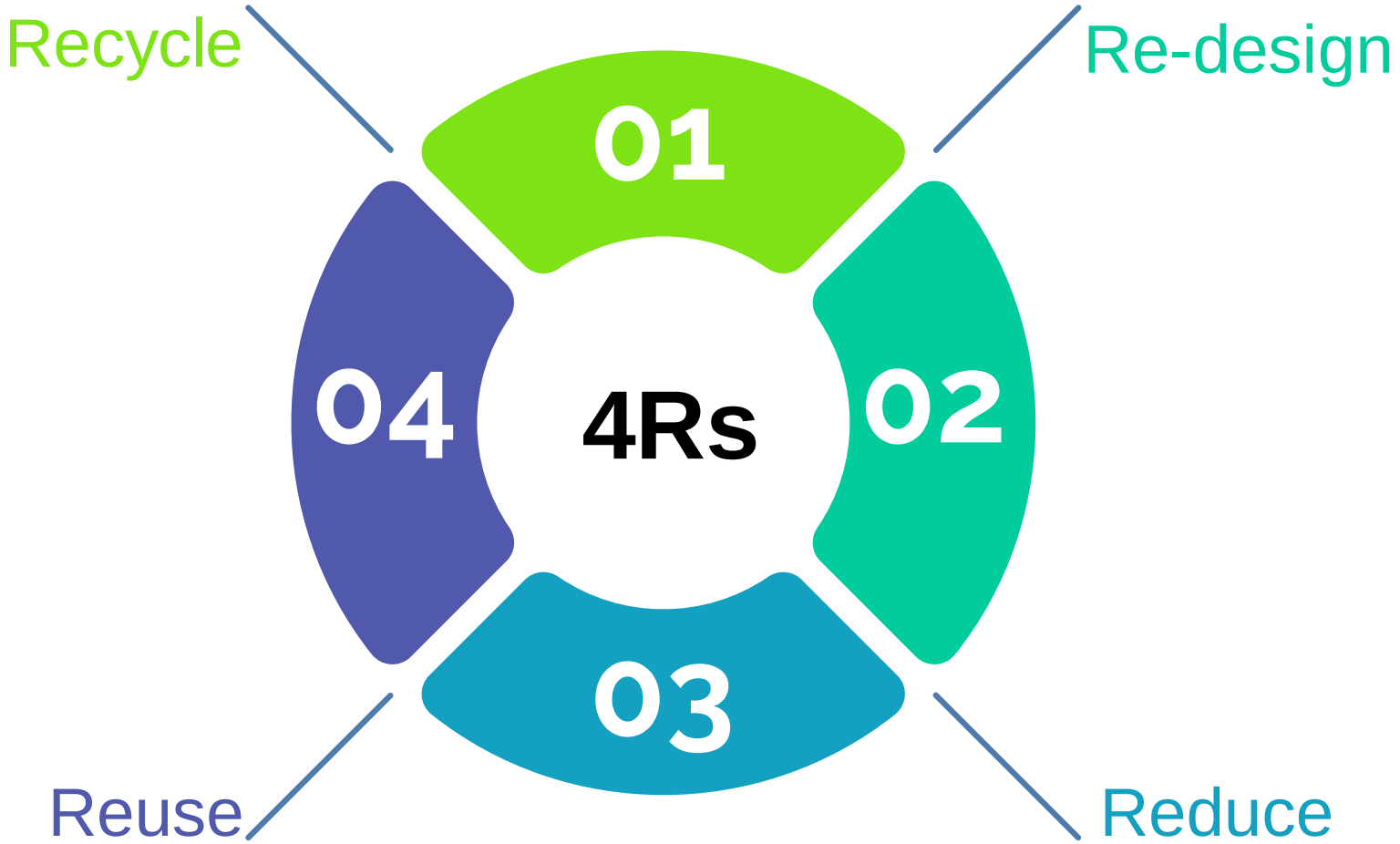
Circular Economy as a paradigm shift

Linear	Circular
Raw materials & waste	Raw materials only
Competition	Collaboration
Individuals	Ecosystem
Do less bad	Do good and Positive
Added value	Shared value
Standardised Production	Local & adapted production
Downcycling	Upcycling

Framework for circular business models in the textile industry (Circle Economy 2015)

Circular	Servitization	Sufficiency
Create Value From Waste The concept of waste is eliminated By turning waste streams into useful and valuable input for other processes	**Functionality over Ownership** Provide services that satisfy users' need without having to own physical products.	**Encourage Effective Resource Use** Solutions that actively seek to reduce consumption and production
Closed Loop Models	**Repair & Warranty**	**Demand Management**
Reuse	**Renting & Leasing**	**Co-Creation**
Recycle	**Pay for Result**	**Use Excess Capacity**

4Rs

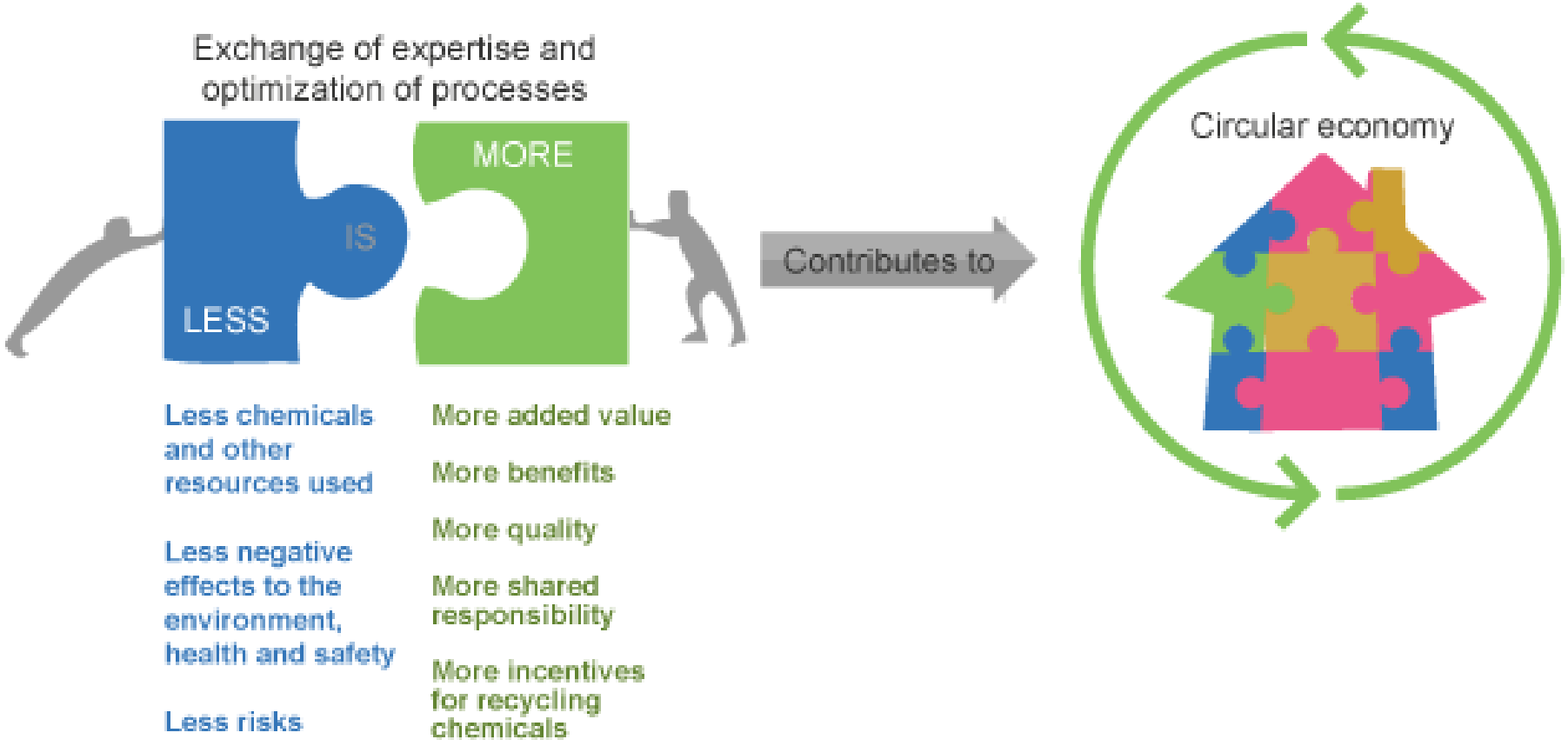


Chemical Leasing is a business model based on the Resource Efficient and Cleaner Production (RECP) concept, which promotes the efficient use of resources, minimization of wastes and emissions, and reduction of health and environmental risks. Chemical Leasing is also in line with the UNIDO strategy on Inclusive and Sustainable Industrial Development, which aims to create shared prosperity and safeguard the environment. The Chemical Leasing business model aims to:

- improve the economic and environmental performance of participating companies, and enhance their access to new markets;
- increase the efficiency of chemical use in industry, and reduce the health and environmental risks resulting from chemical emissions and exposure.

Concept

Chemical Leasing is a service-oriented business model that shifts the focus from increasing the sales volume of chemicals toward a value-added approach. In essence, the model decouples payment from volume. Instead of basing sales price on the volume of chemicals provided, the producer mainly sells the functions the chemicals perform. The functional units (e.g. the number of parts cleaned or the size of the area coated) become the basis for payment. The customer pays for the results, and the volume of chemical used becomes a cost factor for the supplier rather than a revenue factor. The supplier thus has a direct incentive to harness its expertise to reduce the amount of chemical consumed and increase the customer's process efficiency.


Exchange of expertise and optimization of processes
LESS
IS
MORE
Contributes to
Circular economy
Less chemicals and other resources used
Less negative effects to the environment, health and safety
Less risks
More added value
More benefits
More quality
More shared responsibility
More incentives for recycling chemicals

As world fibre consumption passes 100 million tonnes per annum, the time has come to take a step back and challenge whether current, single-use models for chemicals used in the conversion of fibres to finished textile products should be allowed to continue.

Chemicals are used in yarn spinning, weaving, knitting and wet processing (e.g. dyeing, printing, finishing, laundry) and are typically used once only. After use in a particular process, they are either passed to the next actor in a supply chain on a product, removed and dumped into the environment, or partially remediated and dumped into the environment.

How to move away from single-use linear models and increase the recycling and reuse of textile chemicals as non-linear use models.

In order to deliver significant change in the industry, there will have to be significant changes in ways of working, which may only be possible with technical changes in chemical formulations, processing methodology, machinery, infrastructure and logistics

Inevitably, there will be some economic barriers to implementation, and some levers, in the form of incentives or controls, will be required to facilitate some changes.

It is therefore important that key stakeholders such as retail brands, policy makers, legislators and NGOs, which have a track record of driving change throughout the industry, understand the urgent need for radical change, understand what is possible and work collaboratively to enable non-linear use models to flourish.

Reduce net chemical consumption i.e. the total amount of chemicals used;

- Reduce chemical discharge to the environment.
- There are two complementary approaches to achieving this:
- Using lower amounts of chemicals by reducing the amounts deliberately applied in any given process;
- Increasing the amounts of chemicals that are reused and recycled by applying non-linear use models.

'Chemical Leasing' has been proposed as a potential solution to the problems caused by current chemical use models in the textile industry. On the face of it, chemical leasing is a slightly abstract concept where companies sell the function of a chemical rather than the volume of a chemical.

WHAT MAKES A CHEMICAL ‘GOOD’ IN A POST-LINEAR WORLD?

Currently a ‘good’ textile chemical is cost-effective, technically effective, easy to handle, safe and easy to remediate.

The current model assumes that it acceptable for the chemical industry to use very harmful chemicals in very tightly controlled conditions to make textile chemicals. However, it also assumes that users of their products cannot be trusted to employ the same levels of control, and they therefore have to be provided with more benign chemical formulations.

Chemical leasing and non-linear use models do not presume users are non-experts.

Safer chemistry is preferable to less safe chemistry, but chemical leasing services could be provided by experts who use incredibly hazardous, incredibly effective chemicals in a very safe manner in enclosed systems. The focus would be on the function of the chemical and not on the ‘what ifs’ associated with poor handling and irresponsible disposal

Factors to be considered for non-linear use models.

Ease of recycling
Persistence compared with biodegradability. Are there easily recyclable chemicals with great functionality that are currently not used because of their persistence?

Simplicity of formulation over stability or shelf life. Chemical formulations can contain multiple chemicals to aid stability and shelf life. Would simpler formulations with a shorter shelf life be easier to recycle?

Is ‘water-based’ the future?
Most current single-use linear models are based on a requirement that all other chemicals, with the exception of dyes, pigments and chemical finishes that are passed on to the final customer, have to be removed using water-based washing processes.

Organic solvents have got a bad reputation, primarily because poorly contained hazardous solvents can cause severe harm to workers and the environment. However, if managed by experts, solvents offer great potential in terms of the removal and reuse of chemicals

Factors to be considered for non-linear use models.

Are chemical hazards over-prioritised?

If there were a closed loop chemical leasing and recycling system with no leakage and no residues on product, the current restrictions on chemical inputs imposed by Manufacturing Restricted Substance Lists (MRSLs) in particular might need to be reviewed and chemicals that are currently considered as 'upstream use only' (in the chemical industry) might need to be reconsidered for use in downstream facilities.

Using the same chemical for multiple processes

Is there an opportunity for universal chemicals or universal formulations? Currently the selfish user model dictates, for example, that a weaver will use the best size for weaving. But could a semi-solid detergent be used as weaving size? (In other words, could a fabric be 'self-cleaning' when immersed in water?

- This approach is not necessarily a circular approach but one that reduces net chemical consumption.

Are there chemicals that operate as both dyebath lubricants and antioxidants or detergents and antiredeposition aids? This concept suggests that simpler processing baths could be used and reused/recycled more easily than complex, multi-formulation process baths

Factors to be considered for non-linear use models.

Process Bath Stability/Reuse

- Can chemical formulations and recipes be engineered so that process baths can be used several times? For example, could bleaching and scouring baths be monitored to see when they reach saturation of contaminants? Synthetic knit goods have relatively low levels of chemicals on their fibre surface compared to cotton, yet in the majority of cases, the scouring baths are still only used once before being dumped
- It will be necessary to better understand which chemicals in a process bath remain unchanged in a process and which are chemically reacted.

- **Note**: Continuous, counter-flow wash ranges inherently reuse wash baths and their use in placeof more wasteful batch processing is established. Mechanical and engineering solutions will compliment chemical solutions

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