Summary
“Preliminary life cycle assessment of water filters”

This assessment demonstrates that the Aqua *free* reusable filter systems:

- Generates less than 50% of the CO_2 emissions caused by single use systems
- Only 11% of the emissions come from reusable filter manufacturing compared to 94% from single use filter manufacture
- Significant savings on waste disposal

Thanks

This life cycle assessment was funded by Aqua *free* GmbH, which is located in Hamburg (accepted as third party scientific funding by the Institute for Environmental Medicine and Hospital Hygiene at Freiburg University Hospital).

Literature

[1] Daschner, F.D. et al. (1997) Protecting the patient and the environment – new aspects and challenges in hospital infection control. J Hosp Infect; 36:7-15

[2] Dettenkofer, M. et al. (1999) Einweg- versus Mehrweg-Patientenabdeckung im Operationssaal. Ökobilanz: Vergleich von Zellstoff-Polyethylen- und Baumwoll-Mischabdeckung. Chirurg; 70:485–91.

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ÖKOBIL-FLY-GB-04/2016-V001

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Preliminary life cycle assessment of water filters

for the prevention of nosocomial legionellosis

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Introduction and goals

Hospitals produce a lot of waste: in Germany they are responsible for 2% of total refuse production. Additionally the consumption of water and energy per patient is above the national average [1]. As global resources become ever more scarce and environmental burdens increase, healthcare, like every other market sector is looking to adopt ecologically sustainable practices. Life cycle assessments (e.g. on medical devices [2]) highlight the properties of a product that are ecologically relevant. This study is aimed at comparing the environmental effects of the use of reusable and single-use filter systems for the prevention of nosocomial legionellosis. It focuses on system-related properties of point of use water filters. Different filter manufacturers are not compared directly. The results serve to identify the potential for ecological optimisation and aid inclusion in water hygiene strategies.

Material and methods

With reference to DIN EN ISO 14040 and 14044 related to life cycle assessment, the following sections of the product life cycle were subjected to analysis: manufacture, (re-)conditioning, (re-)distribution and waste treatment. The following simplifications were necessary: (a) Global Warming Potential (GWP_{100}) and Cumulative Energy Demand (CED) were selected as impact categories, (b) calculations were made for a hypothetical single-use filter based on existing models and (c) certain assumptions were made, primarily with regard to the single-use system. The functional unit (FU) selected was 1,000 filters; calculations for the reusable model assumed about 20 reconditioning cycles. The LCA software package Umberto 5.5 and the EcoInvent 2.1 database were used.

Results

With regard to GWP_{100} the reusable system caused less than 50% of the emissions resulting from the single-use system: 584 kg/FU as opposed to 1,249 kg/FU (CO_2-equivalent)

	Reusable system		Single-use system	
Manufacture	**68 kg**	**11 %**	**1,175 kg**	**94 %**
(Re-)conditioning	**436 kg**	**75 %**		
Distribution	40 kg	7 %	27 kg	2 %
Redistribution	40 kg	7 %		
Waste treatment	(16 kg)*		48 kg	4 %
Total	**584 kg**	**100 %**	**1,249 kg**	**100 %**

Table 1: Comparison of greenhouse gas emissions (CO_2-equivalents)

*Included here for comparison purposes only; – already included in reconditioning figure.

As shown by the summary of the analysis in Table 1, the reconditioning process was responsible for 75% of the total emissions of the reusable system. Most of this resulted from the consumption of electrical energy – causing almost half (46%) of the total greenhouse gas emissions of the reusable system.

Most of the emissions caused by the single-use system – 94% – came from filter manufacture compared to only 11% for the reusable system.

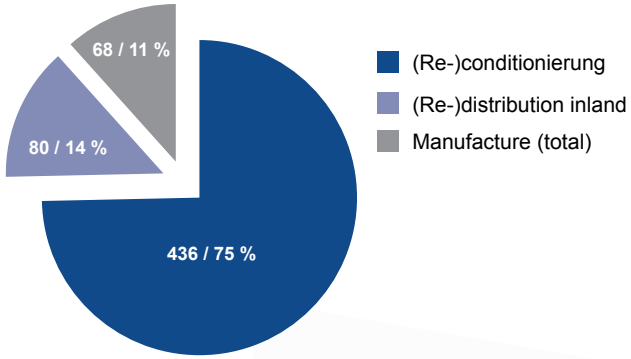

Figure 1: Reusable system – analysis of contribution of manufacture to GWP_{100}

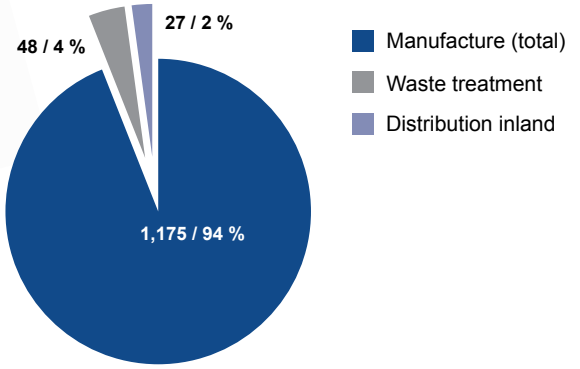

Figure 2: Single-use system – analysis of contribution of manufacture to GWP_{100}

The results in the CED category of material flow analysis as indicated in Table 2 yielded similar percentage results and show that the cumulative energy demand was 11,396 MJ/FU for the reusable system and 25,345 MJ/FU for the single-use system.

	Reusable system		Single-use system	
Manufacture	**1,311 MJ**	**11 %**	**24,853 MJ**	**98 %**
(Re-)conditioning	**8,739 MJ**	**77 %**		
Distribution	673 MJ	6 %	451 MJ	2 %
Redistribution	673 MJ	6 %		
Waste treatment	(13 MJ)*		41 MJ	0 %
Total	**11,396 MJ**	**100 %**	**25,345 MJ**	**100 %**

Table 2: Comparison of Cumulative Energy Demand (CED) in MJ

*Included here for comparison purposes only; – already included in reconditioning figure.

Conclusion

This assessment shows the reusable system to be clearly superior in the impact categories of Global Warming Potential and Cumulative Energy Demand. It presents a realistic approximation because real data was available on the manufacturers' processes for single-use filter systems.