
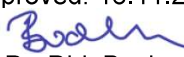


HM020005147D	SCIENTIFIC REPORT	 <b>HOCHSCHULE RHEIN-WAAL</b> Rhine-Waal University of Applied Sciences
<b>Determination of the virucidal efficacy of two Arçelik A.S. dishwasher models</b>		

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**Carried out at**

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**By order of**

Arçelik A.S.

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## 1 Aim

The assessment of two dishwasher models (beko models DEN36X30W and DFN26425X) in terms of virucidal efficacy.

## 2 Applicable documents

Brands, B., Schulze Struchtrup, S., Stamminger, R. and Bockmühl, D. (2020), A method to evaluate factors influencing the microbial reduction in domestic dishwashers. J Appl Microbiol, 128: 1324-1338. doi:10.1111/jam.14564


Heinzel, M., Kyas, A., Weide, M., Breves, R. and Bockmühl, DB. (2010), Evaluation of the virucidal performance of domestic laundry procedures. International Journal of Hygiene and Environmental Health, 213: 334-337. doi: 10.1016/j.ijheh.2010.06.003

Parshionikar, S., Laseke, I., Fout, G. S. (2010), Use of Propidium Monoazide in Reverse Transcriptase PCR To Distinguish between Infectious and Noninfectious Enteric Viruses in Water Samples. Appl. Environ. Microbiol, 76: 4318-4326. doi: 10.1128/AEM.02800-09

Zinn, MK., Klapper, D., Von Esmarch-Rummler, B. and Bockmühl, D. (2018), Development of a Test Method for Analyzing the Hygienic Performance of Commercial Dishwashers Operating on the Fresh Water Principle. Tenside Surf. Det., 55 (5): 376-382.

DIN EN 14476:2019-10

DIN EN 50242/DIN EN 60436:2018-06;VDE 0705-436:2018-06

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## 5.4 Summary of results

Table 1: Summary of logarithmic reduction of viruses.

	DFN26425X		DEN36X30W	
	<i>mNoV</i>	<i>bCoV</i>	<i>mNoV</i>	<i>bCoV</i>
<b>P1 Eco 50°C</b>	4.1	4.8	4.3	4.8
<b>P3 Intensive 70°C</b>	≥5	≥5	≥5	≥5

Table 2: Summary of % reduction of viruses.

	DFN26425X		DEN36X30W	
	<i>mNoV</i>	<i>bCoV</i>	<i>mNoV</i>	<i>bCoV</i>
<b>P1 Eco 50°C</b>	99.990%	99.995%	99.994%	99.998%
<b>P3 Intensive 70°C</b>	≥99.999%	≥99.999%	≥99.999%	≥99.999%

## 6 Conclusion

### 6.1 “Eco” program (P1 Eco 50°C)

Both dishwasher models (DFN26425X and DEN36X30W) show a sufficient (based on DIN EN 14476:2019-10) logarithmic reduction (LR) for the *Eco* 50°C program. The mean LR for *mNoV* and *bCoV* is 4.1 and 4.8 for model DFN26425X and 4.3 and 4.8 for model DEN36X30W.

### 6.2 “Intensive” program (P3 70°C)

Both dishwasher models (DFN26425X and DEN36X30W) show a maximum logarithmic reduction (LR) for the “Intensive” 70°C program. The mean LR for *mNoV* and *bCoV* is ≥5 for DFN26425X and DEN36X30W.

### 6.3 “Intensive” program (P3 70°C) with “hygiene intense” function

The “Intensive” program (P3 70°C) already leads to an almost total virucidal reduction. The activated “hygiene intense” function causes a longer rinse cycle with longer hot phases. The maximum temperature measured is slightly higher than that of the “intensive” program alone. **Based on these results, it can be clearly concluded that the virucidal reduction is at least equal, if not higher when using the “intensive” program (P3 70°C) with the “hygiene intense” function.**

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## 7 Discussion

In this study, the viral strains of bovine coronavirus (*bCoV S379 Riems*) and murine norovirus (*mNoV S99*) were used to assess the antiviral efficacy of dishwasher programs. These two strains serve as surrogates because they are closely related to the human pathogens SARS CoV-2 and Norwalk Virus. Furthermore an enveloped and non-enveloped virus was used, to account for the fact that in general non-enveloped viruses are more resistant than enveloped viruses. See also Table 3 for comparison of viral strains.

Table 3: Comparison of human viral pathogens and the viruses used in this study.

	SARS Cov2	bCoV S99	Norwalk Virus	mNoV S99
<b>Realm:</b>	Riboviria	Riboviria	Riboviria	<i>Riboviria</i>
<b>Kingdom:</b>	Orthornavirae	Orthornavirae	Orthornavirae	Orthornavirae
<b>Phylum:</b>	Pisuviricota	Pisuviricota	Pisuviricota	Pisuviricota
<b>Class:</b>	Pisoniviricetes	Pisoniviricetes	Pisoniviricetes	Pisoniviricetes
<b>Order:</b>	Nidovirales	Nidovirales	Picornavirales	Picornavirales
<b>Family:</b>	Coronaviridae	Coronaviridae	Caliciviridae	Caliciviridae
<b>Genus:</b>	Betacoronavirus	Betacoronavirus	Norovirus	Norovirus
<b>Subgenus:</b>	Sarbecovirus	Betacoronavirus 1	-	-
<b>Species:</b>	Severe acute respiratory syndrome-related coronavirus	Bovine coronavirus	Norwalk Virus	Murines Norovirus
<b>Strain:</b>	SARS Cov-2	S379 Riems	-	S99
<b>Specifications:</b>	enveloped, positive-sense, single-stranded RNA virus	enveloped, positive-sense, single-stranded RNA virus	non- enveloped, positive-sense, single-stranded RNA virus	non- enveloped, positive-sense, single-stranded RNA virus
	<b>human pathogen</b>	<b>test surrogate</b>	<b>human pathogen</b>	<b>test surrogate</b>

\* <https://www.european-virus-archive.com>

**Based on the results of this report, the current literature and DIN EN 14476:2019-10, the hygienic efficacy of dishwasher models DFN26425X and DEN36X30W is state of the art. Bovine Coronavirus and murine Norovirus are reduced by  $\geq 99.99\%$ , depending on the dishwasher program used.**