



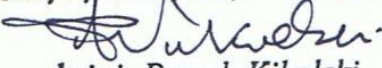
Subject title

**COMPARATIVE ASSESSMENT OF DETERGENCY
OF 2 WASHING CAPSULES**

**TEST AT 14 SOILS / STAINS
ACCORDING TO A.I.S.E.
AT A TEMPERATURE OF 40°C**

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1. GROUNDS OF THE RESEARCH STUDIES

The research studies were conducted on the basis of an order by LAKMA STREFA Ltd. Co. in line with an e-mail on 28.08.2015.

2. SCOPE OF THE RESEARCH STUDIES

The research studies consisted in the comparative assessment of detergency of "Do białego" ["For white washing"] washing capsules made by LAKMA STREFA Ltd. Co. and HENKEL produced in accordance with the arrangements with the Ordering Party at a temperature of 40°C in drum washing machines in relation to 14 soils / stains by AISE. Dosage of capsules: 1 pieces / washing cycle.

3. RESEARCH-STUDIED PRODUCTS

The following products provided by the Ordering Party were research-studied.

- PERLUX Super Compact White Perły Piorące (LAKMA STREFA Ltd. Co.);
batch - no marking; bar-code: 5 907542 740010
- Persil Power-Mix Caps (HENKEL)
batch - 24 07 2015 10:59 K0 28; bar-code: 9 000 100 940085

4. RESEARCH STUDIES AND MEASUREMENTS

4.1. Terms of the tests and their performance

The research studied covered tests of one-off washing in drum washing machines with the application of the following conditions:

- Comparative test in BOSCH washing machines at 3 external repetitions (3 washing machines)
- Dosage of capsules: 1 pieces / washing cycle
- Washing program: vigorous washing
- Washing temperature: 40°C
- Test on soils / stains on fabric/ cotton fabric (monitors):
 - Tea WE5LTWKC, (Warwick Equest),
 - Coffee WEL-042kc, (Warwick Equest),
 - Red wine WE5RWWKC, (Warwick Equest),
 - Fruit juice CFT CS15, (CFT BV),
 - Tomato purée WE5TPWKC, (Warwick Equest),
 - Food for infants (with carrots) WE5IACBFWKC, (Warwick Equest),
 - French mustard WE5FSMWKC, (Warwick Equest),
 - Chocolate drink CFT CS44, (CFT BV),
 - Grass CFT CS08, (CFT BV),
 - Grass / mud WE5GMWKC, (Warwick Equest),
 - Blood WE5DASBWKC, (Warwick Equest),

- Not-used motor oil CFT C01, (CFT BV),
- Cooking beef fat WE5BBWKC, (Warwick Equest),
- Make-up CFT CS17, (CFT BV)
- Washing machine input: 3.5 kg composed of:
 - Cotton pillowcases according to IEC 60456, pre-washing
 - Cotton towels according to IEC 60456, pre-washing
 - Fabric (SBL 2004) - a donor of mixed dirt - washing load containing oily substances, protein substances, active oxygen consuming substances, starch, molecular dirt, urea and carbon black, 4 pieces.
- Test soil / stain monitors
- Tap water, hardness 12°dH
- Compared effects of washing: changes of brightness (clearness) dY of soil / stain monitors
- Measuring conditions for brightness (clearness) Y
 - Apparatus: spectrophotometer (Datacolor 400)
 - Measurement geometry: d/8°
 - Observer (D65/10°)
 - UV cutting filter UV 420 nm
- Comparison of variances (statistical significance) in mean values dY through u-Lord non-parametric statistical testing at level of statistical significance at 95%

Zero clearness (brightness) measurements Y were conducted for all types of monitors. Monitors were attached to a carrier (pillowcase) (7 pieces at each) and then subjected to washing. After completion of washing they were dried in the air and ironed at a temperature of approx. 150°C. Then again, their brightness (clearness) Y was measured. Individual and average dY values were calculated for individual washing units. The obtained average dY values (their variances) were compared for individual monitors.

Also the tested capsules were subjected to ranking (order-arrangement) based on the total of points given for a position in the ranking on their capabilities to remove various stains / soils and on the assumption that the total of average values of brightness (clearness) changes dY stands for the global measure of quality of the tested products.

4.2. Test results

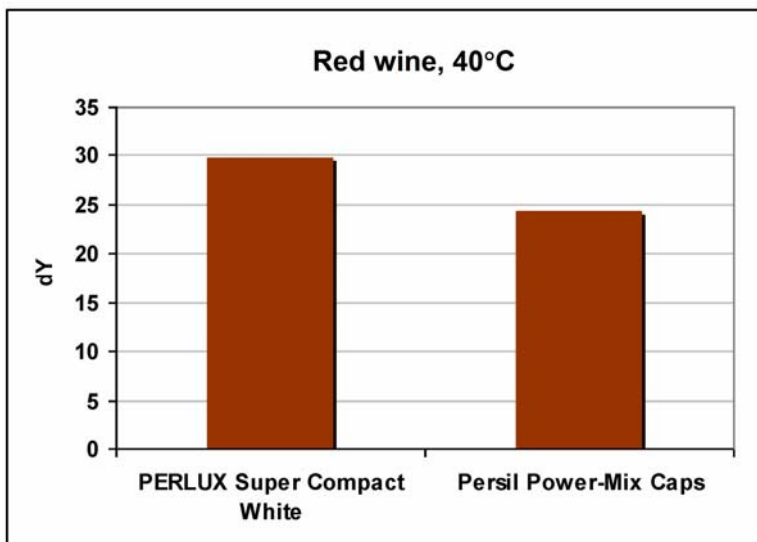
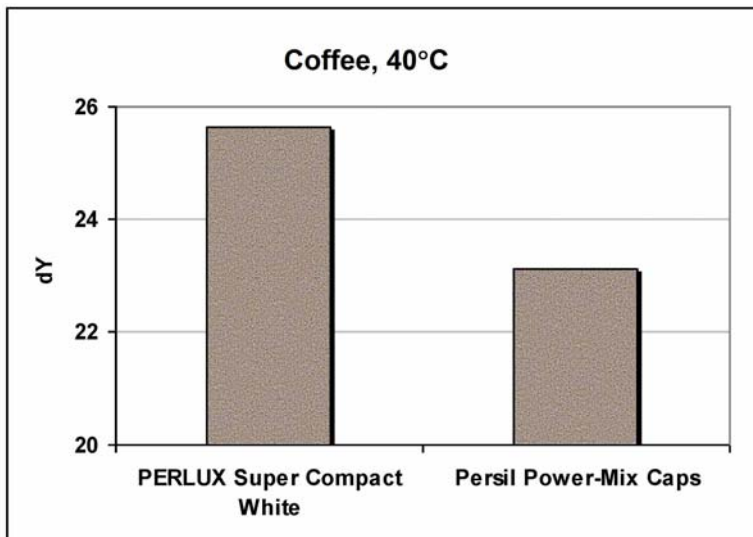
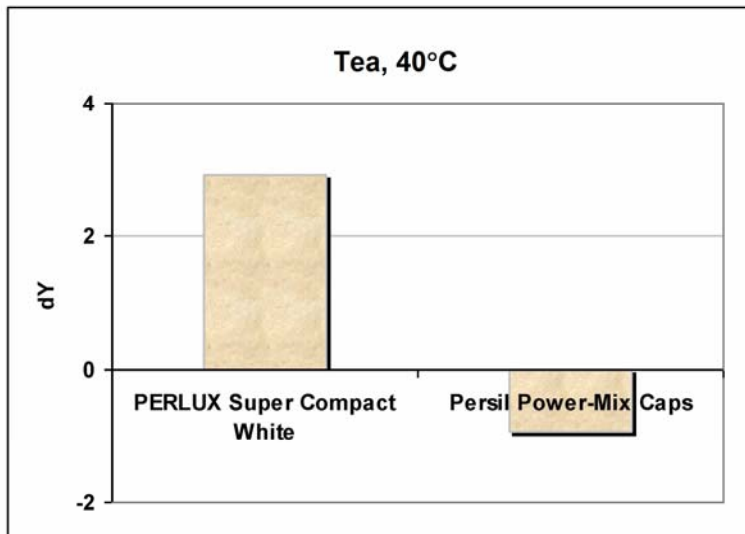
The obtained results are presented in Table 1.

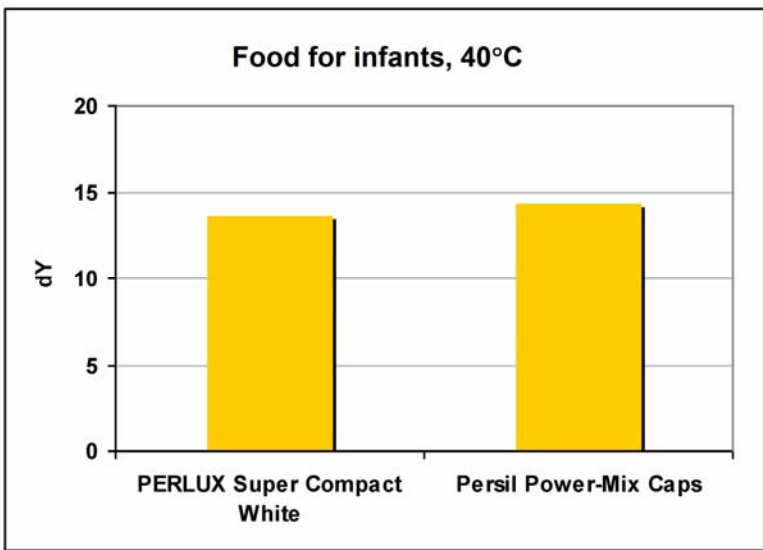
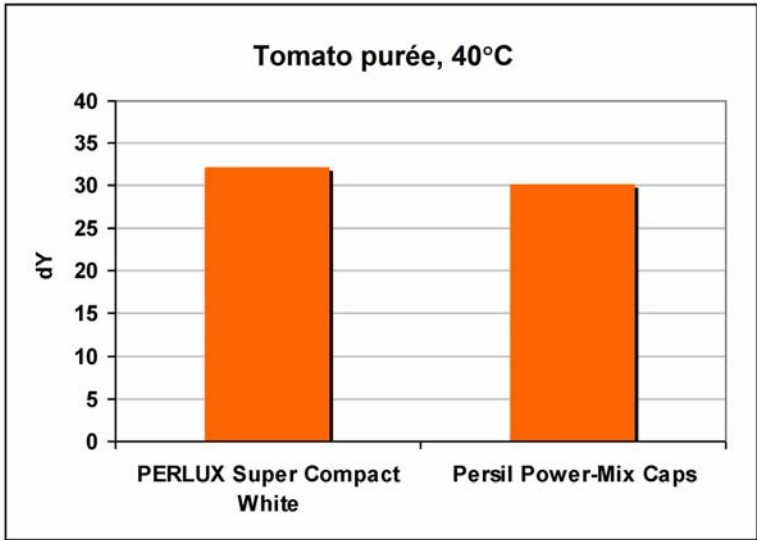
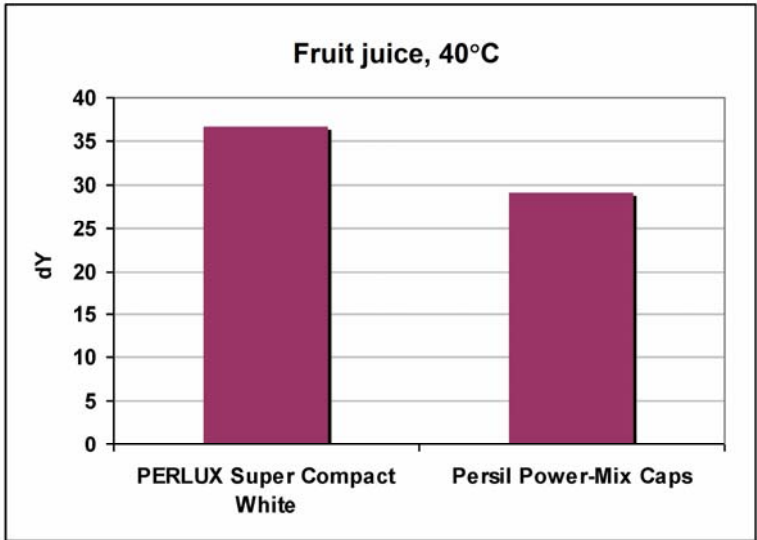
Table 1. Results of washing operations at a temperature of 40°C, expressed as dY

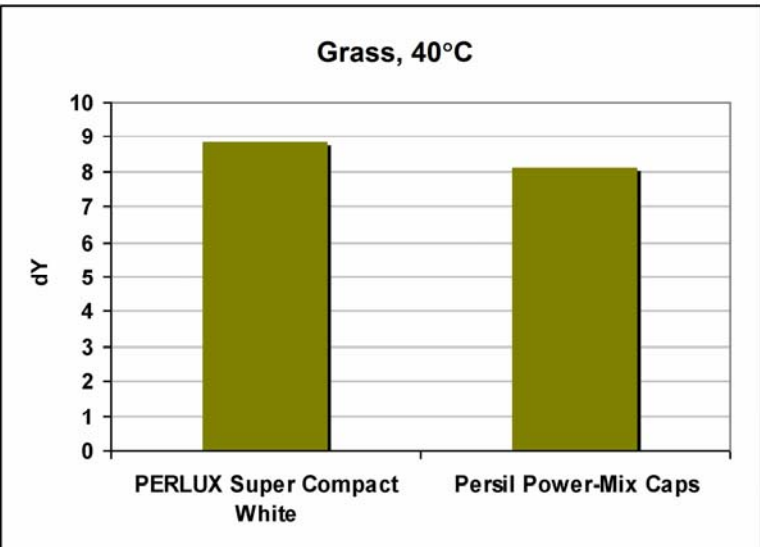
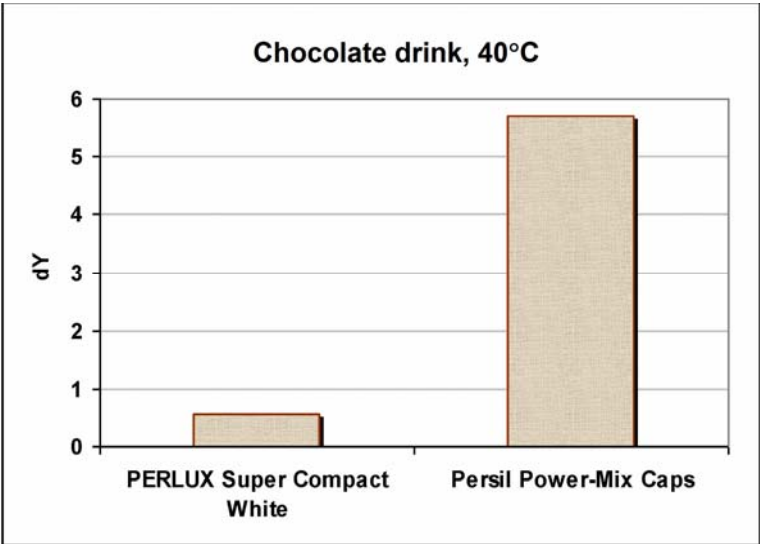
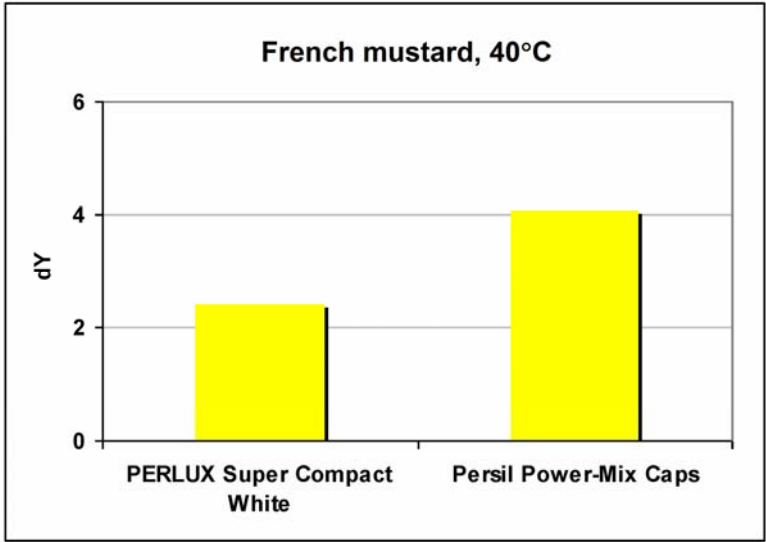
Soil / stain	ΔY		
	Result	PERLUX Super Compact White	PERSIL Power-Mix Caps
Tea WE5LT	1	3.94	1.94
	2	2.47	-2.47
	3	2.40	-2.29
	Ave.	2.94	-0.94
Coffee WE1-042kc	1	24.93	24.30
	2	26.41	21.74
	3	25.54	23.30
	Ave.	25.63	23.11
Red wine WE5RW	1	27.52	25.14
	2	29.67	24.42
	3	31.82	23.04
	v	29.67	24.20
Fruit juice CFT CS 15	1	35.22	29.65
	2	38.66	28.62
	3	35.76	28.96
	Ave.	36.55	29.08
Tomato purée WE5TP	1	28.24	31.50
	2	37.27	30.79
	3	30.34	27.47
	Ave.	31.95	29.92
Food for infants WE5IACBF	1	14.80	13.09
	2	12.09	16.30
	3	13.78	13.49
	Ave.	13.56	14.29
French mustard WE5FSM	1	5.45	4.83
	2	0.24	3.67
	3	1.48	3.64
	Ave.	2.39	4.05
Chocolate drink C-S- 44	1	0.18	4.97
	2	-0.17	6.42
	3	1.68	5.72
	Ave.	0.56	5.70
Grass CFT CS08	1	9.42	7.60
	2	8.94	8.47
	3	8.16	8.21
	Ave.	8.84	8.09
Grass/mud WE5GM	1	23.69	20.11
	2	26.25	19.58
	3	17.58	20.97
	Ave.	22.51	20.22
Blood WE5DASBWKC	1	51.26	49.19
	2	50.98	48.93
	3	47.16	47.70
	Ave.	49.80	48.61
Non-used motor oil CFT C01	1	4.62	6.88
	2	4.36	5.93
	3	5.16	6.32
	Ave.	4.71	6.38
Cooking beef fat WE5BB	1	9.29	10.97
	2	9.59	9.89
	3	7.10	11.13
	Ave.	8.66	10.66
Make-up CFT CS17	1	9.51	8.22
	2	4.61	10.27
	3	6.74	8.73
	Ave.	6.95	9.07

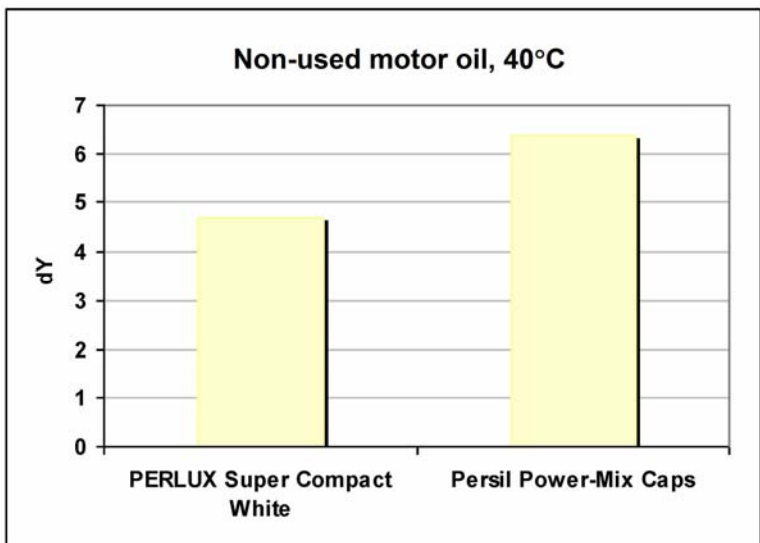
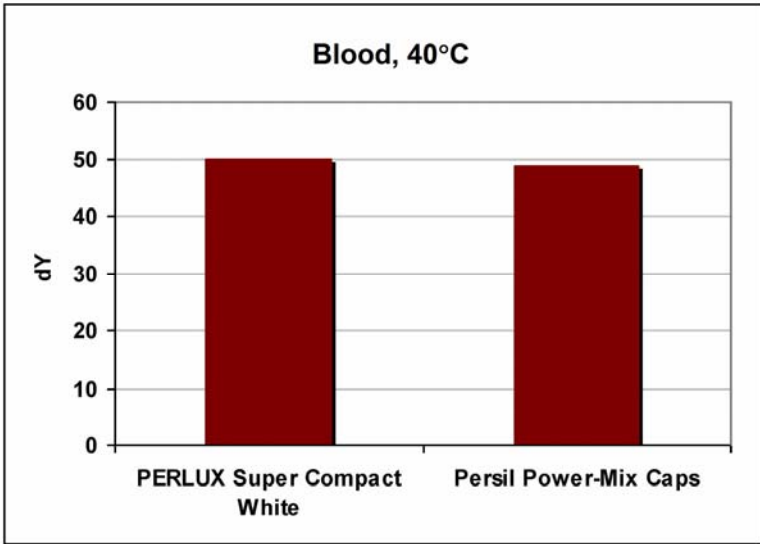
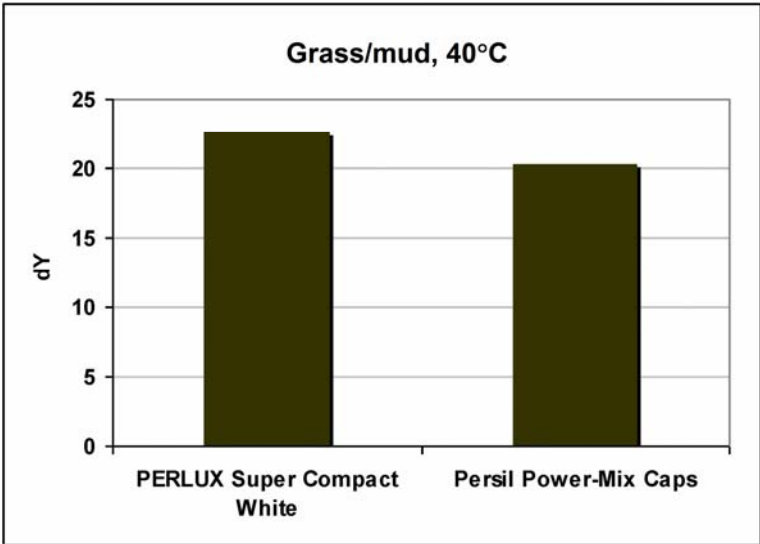
The test results on washing operations are presented at Figure 1.

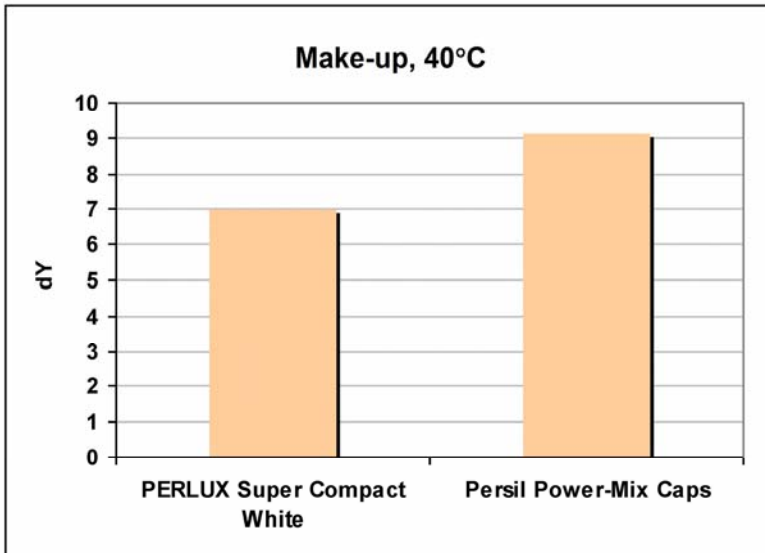
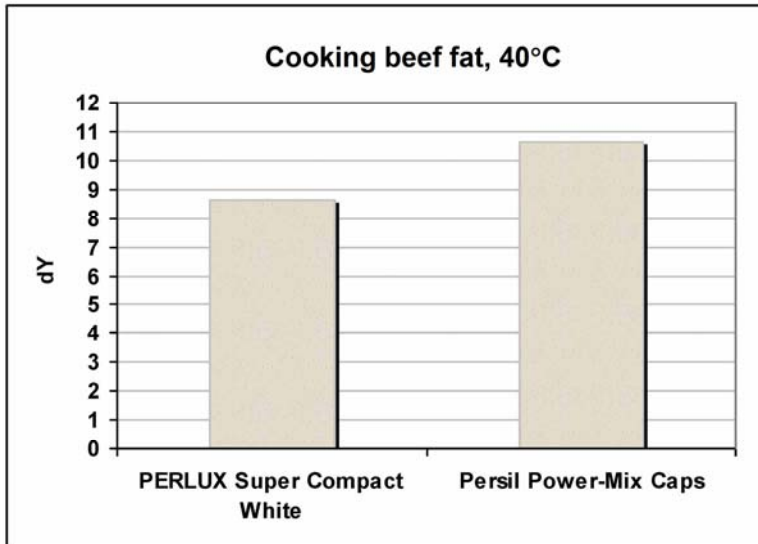
Figure 1. Visualisation of the test results on washing operations of capsules at a temperature of 40°C











5. ASSESSMENT OF VARIANCES IN EFFECTIVENESS TO REMOVE THE TESTED SOILS / STAINS

5.1. *The ranking of the results of capabilities to remove soils / stains and statistical analysis on significance of their variances*

The ranking of the results and statistical analysis on significance of their variances in the range of effectiveness to remove soils / stains by the tested capsules at a temperature of 40°C conducted by means of u-Lord test is given in Table 2.

Table 2. Ranking of capsules and u-Lord testing

Soil / Stain	Ranking	u-Lord test result
Tea WE5LT	PERLUX > PERSIL	u = 1.35 > u_{kr} = 0,636 Different results in terms of statistical significance
Coffee WEI-042kc	PERLUX > PERSIL	u = 2.33 > u_{kr} = 0,636 Different results in terms of statistical significance
Red wine WE5RW	PERLUX > PERSIL	u = 2.49 > u_{kr} = 0,636 Different results in terms of statistical significance
Fruit juice CFT CS 15	PERLUX > PERSIL	u = 3.10 > u_{kr} = 0,636 Different results in terms of statistical significance
Tomato purée WE5TP	PERLUX > PERSIL	u = 0.41 < u _{kr} = 0,636 No difference in terms of statistical significance
Food for infants WE5IACBF	PERSIL > PERLUX	u = 1.47 > u_{kr} = 0,636 Different results in terms of statistical significance
French mustard WE5FSM	PERSIL > PERLUX	u = 0.41 < u _{kr} = 0,636 No difference in terms of statistical significance
Chocolate drink C-S-44	PERSIL > PERLUX	u = 12.85 > u_{kr} = 0,636 Different results in terms of statistical significance
Grass CFT CS08	PERLUX > PERSIL	u = 1.91 > u_{kr} = 0,636 Different results in terms of statistical significance
Grass/mud WE5GM	PERLUX > PERSIL	u = 0.31 < u _{kr} = 0,636 No difference in terms of statistical significance
Blood WE5DASBWKC	PERLUX > PERSIL	u = 0.46 < u _{kr} = 0,636 No difference in terms of statistical significance
Non-used motor oil CFT C01	PERSIL > PERLUX	u = 11.09 > u_{kr} = 0,636 Different results in terms of statistical significance
Cooking beef fat WE5BB	PERSIL > PERLUX	u = 1.60 > u_{kr} = 0,636 Different results in terms of statistical significance
Make-up CFT CS17	PERSIL > PERLUX	u = 0.74 > u_{kr} = 0,636 Different results in terms of statistical significance

5.2. *Global ranking of capsules based on the results of washing capabilities aimed to remove 14 soils / stains*

Two methods of ranking was applied:

- (1) on the basis of scoring a position in the ranking and
- (2) on the basis of the total brightness (clearness) changes dY.

5.2.1. Ranking of capsules based on the total points given for a position in the ranking

This ranking was aimed to determine the total of points given for a position of individual capsules in the ranking on washing capabilities to remove individual soils / stains. A sample which removes dirt / stains better gets 1 point, and the second in the order and a sample which removes dirt / stains worse - 2 points. An individual capsule position throughout the test is determined by the total of points obtained. The lower total points, the higher effectiveness. The obtained results are presented in Table 3.

Table 3. Ranking of capsules in terms of their overall capabilities to remove soils / stains defined as the total points given for a position in the ranking

Soil / Stain	PERLUX Super Compact White		PERSIL Power-Mix Caps	
	Tea	2.94	Pos. 1 = 1 point	-0.94
Coffee	25.63	Pos. 1 = 1 point	23.11	Pos. 2 = 2 points
Red wine	29.67	Pos. 1 = 1 point	24.20	Pos. 2 = 2 points
Fruit juice	36.55	Pos. 1 = 1 point	29.08	Pos. 2 = 2 points
Tomato purée	31.95	Pos. 1 = 1 point	29.92	Pos. 2 = 2 points
Food for infants	13.56	Pos. 2 = 2 points	14.29	Pos. 1 = 1 point
French mustard	2.39	Pos. 2 = 2 points	4.05	Pos. 1 = 1 point
Chocolate drink	0.56	Pos. 2 = 2 points	5.70	Pos. 1 = 1 point
Grass	8.84	Pos. 1 = 1 point	8.09	Pos. 2 = 2 points
Grass/mud	22.51	Pos. 1 = 1 point	20.22	Pos. 2 = 2 points
Blood	49.80	Pos. 1 = 1 point	48.61	Pos. 2 = 2 points
Non-used motor oil	4.71	Pos. 2 = 2 points	6.38	Pos. 1 = 1 point
Cooking beef fat	8.66	Pos. 2 = 2 points	10.66	Pos. 1 = 1 point
Make-up	6.95	Pos. 2 = 2 points	9.07	Pos. 1 = 1 point
Total points	20		22	
Position	I		II	

5.2.2. Ranking of capsules based on the total of monitor brightness (clearness) changes dY

This general ranking of capsules was made assuming that the total average values of brightness (clearness) changes dY obtained for 14 tested soils / stains monitors may be taken as a measure of the global quality of the tested products. With this approach taken into consideration, the higher total of all dY values, the better global washing properties. The obtained results are presented in Table 4.

Table 4. Ranking of capsules in terms of their overall capabilities to remove soils / stains defined as the total brightness (clearness) variance values dY_{sr}.

Product	Total dY _ś	Position PE
PERLUX Super Compact White Perły Piorące (LAKMA)	244.71	I
Persil Power-Mix Caps (HENKEL)	232.45	II