



Bathroom Cleaning

DOWANOL Glycol Ethers Formulary Key Findings

Notable	<ul style="list-style-type: none"> A 0.1-unit difference in performance is experimentally significant. A 0.3-unit difference is visually noticeable. Surfactant packages were enhanced as solvents were varied; as more hydrophobic solvents were introduced to the system, a more hydrophilic surfactant package was added to balance the formulation.
Bathroom Cleaners	<ul style="list-style-type: none"> Less DOWANOL PnB is required than EB (4% vs. 5.7%) at similar cost to achieve similar performance. Less DOWANOL DPnB is required than DB (3.2% vs. 4%) at a lower cost (\$0.0531 vs. \$0.0557) to achieve better performance (0.81 vs. 0.60).
Overall	<ul style="list-style-type: none"> These non-optimized glycol ether formulations perform similarly or better than several leading commercial hard surface cleaners. P-series glycol ethers are shown to be as --or even more -- effective at lower cost than E-series glycol ethers. Plus, P-series glycol ethers have favorable toxicology profiles. P-series glycol ethers are not considered to be Hazardous Air Pollutants (HAPs), and they are not subject to the regulations of SARA 313 for annual release reporting requirements.

Bathroom Cleaner Formulations

Formulations	Performance [^]	Water	DOWANOL* PnB	DOWANOL DPnB	DOWANOL EB	DOWANOL DB	DOWANOL PnP	DOWANOL DPnP	VERSENE* 100	Citric Acid ¹	Neodol ² 91-6	DDBSA ³	Formulation Cost, \$/lb.
1	0.97	91.5	4						0.5	3	0.5	0.5	0.0529
2	0.97	89.8			5.7				0.5	3		1	0.0532
3	0.97	91.5		4					0.5	3	0.5	0.5	0.0593
4	0.81	92.3		3.2					0.5	3	0.5	0.5	0.0531
5	0.60	91.5				4			0.5	3	0.5	0.5	0.0557
6	0.56	91.9				3.6			0.5	3	0.5	0.5	0.0530
7	0.63	91.5						4	0.5	3	0.5	0.5	0.0625
8	0.57	92.6						2.9	0.5	3	0.5	0.5	0.0531
9	0.55	91.5					4		0.5	3	0.5	0.5	0.0565
10	0.57	92.0					3.5		0.5	3	0.5	0.5	0.0530
11	0.81	91.5		2				2	0.5	3	0.5	0.5	0.0609
12	0.72	92.5		1.5				1.5	0.5	3	0.5	0.5	0.0528
Commercial A	1.14												
Commercial B	0.93												
Commercial C	0.48												
Commercial D	0.47												
Commercial E	0.43												
Raw Material Cost, \$/lb.			0.61	0.77	0.43	0.68	0.7	0.85	0.49	0.62	0.7225	0.765	

Formulation amounts expressed in weight %.
Residue levels remain constant at 3.21%.

^ As compared to a leading commercial bathroom cleaner as tested by a modified CSMA method;
values > 1.0 indicate the test cleaner outperformed the standard.

A 0.1 unit difference is considered significant; a 0.3-unit difference is visually noticeable.

Prices represented are in U.S. dollars, bulk quantity, Oct. 1997.

* Trademark of The Dow Chemical Company

¹Wego Chemical & Mineral Corp.

²Shell Chemical

³Witco 1298-soft (Witco)

Notes:

DOWANOL glycol ethers soften soap scum

VERSENE chelant binds hard water ions (calcium, magnesium)

Citric acid solubilizes soap scum

Neodol 91-6 is the wetting agent

DDBSA is the primary surfactant

