

BULLETIN VC-703C (Supersedes VC-703B)

Aqualon Benecel™ E10M and K200M HPMC

Surfactant Compatibility

The successful use of water-soluble polymers in shampoos, hair conditioners, body washes and hand soaps requires compatibility between the water-soluble polymer and the surfactant used in the formulation. Because of this, a study was done to check the compatibility of Ashland's Benecel E10M and K200M hydroxypropylmethylcellulose (HPMC) with surfactants frequently used in these applications.

These studies were done by dissolving the water-soluble polymer in deionized water. The surfactant solutions were then added to the polymer solution. Two concentrations of the water-soluble polymer were tested (0.50 wt% active and 1.00 wt% active), and each concentration was tested with both 6.00 wt% active and 12.00 wt% active surfactant. Compatibility was defined as the maintenance of a single homogeneous phase. The results are tabulated on the following pages to help formulators see trends in viscosifying ability depending on which type of surfactant and HPMC are chosen.

It is important to remember that a shampoo is generally composed of more than one surfactant. Incompatibility of a water-soluble polymer with one surfactant does not preclude its use in the formulation if good compatibility exists with the other surfactants chosen.

It is also important to note that while surfactants can be thickened with salt, there are drawbacks. Salts become ineffective thickeners when trying to minimize the amount of surfactant used in formulations. Surfactants that are thickened with salts can lead to skin and eye irritation, which are reduced when using HPMC as a thickening agent. By thickening surfactants with salt, the consumer also loses the benefit of the non-tacky skin after-feel. HPMC is also a non-corrosive product in manufacturing equipment.

Benecel E10M polymer Use Level = 0.50 wt% Active
Surfactant Use Level = 6.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	8	99.8	6.28
Ammonium laureth sulfate (1 EO)	Yes	7	99.6	6.46
Ammonium laureth sulfate (2 EO)	Yes	8	99.9	4.89
Ammonium laureth sulfate (3 EO)	Yes	29	99.8	5.61
Sodium lauryl sulfate	Yes	6	99.8	8.53
Sodium laureth sulfate (1 EO)	Yes	7	99.6	8.69
Sodium laureth sulfate (2 EO)	Yes	10	99.8	7.80
Sodium laureth sulfate (3 EO)	Yes	18	99.9	8.80
Cocamidopropyl betaine	Yes	47	99.9	5.49
Alkylpolyglucosides	Yes	46	19.8	10.70
Lauramine oxide	Yes	44	99.5	7.60
Sodium cocoamphoacetate	Yes	41	99.2	8.90
Disodium cocoamphodipropionate	Yes	51	98.5	9.60

Benecel™ E10M polymer Use Level = 0.50 wt% Active
Surfactant Use Level = 12.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	33	99.8	6.31
Ammonium laureth sulfate (1 EO)	Yes	10	99.5	6.52
Ammonium laureth sulfate (2 EO)	Yes	14	99.9	4.91
Ammonium laureth sulfate (3 EO)	Yes	56	99.8	5.61
Sodium lauryl sulfate	Yes	9	99.8	8.69
Sodium laureth sulfate (1 EO)	Yes	8	99.7	8.77
Sodium laureth sulfate (2 EO)	Yes	15	99.9	7.79
Sodium laureth sulfate (3 EO)	Yes	44	99.8	9.06
Cocamidopropyl betaine	Yes	58	99.9	5.50
Alkylpolyglucosides	No	—	—	—
Lauramine oxide	Yes	65	99.7	7.63
Sodium cocoamphoacetate	Yes	65	95.2	8.72
Disodium cocoamphodipropionate	Yes	87	98.0	9.64

Benecel E10M polymer Use Level = 1.00 wt% Active
Surfactant Use Level = 6.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	22	99.9	6.26
Ammonium laureth sulfate (1 EO)	Yes	16	99.8	6.46
Ammonium laureth sulfate (2 EO)	Yes	33	97.7	5.08
Ammonium laureth sulfate (3 EO)	Yes	218	99.8	5.52
Sodium lauryl sulfate	Yes	11	99.6	8.46
Sodium laureth sulfate (1 EO)	Yes	14	99.5	8.68
Sodium laureth sulfate (2 EO)	Yes	26	99.2	8.01
Sodium laureth sulfate (3 EO)	Yes	120	99.5	8.86
Cocamidopropyl betaine	Yes	503	99.4	5.50
Alkylpolyglucosides	Yes	480	12.8	10.73
Lauramine oxide	Yes	485	98.9	7.61
Sodium cocoamphoacetate	Yes	474	98.7	8.91
Disodium cocoamphodipropionate	Yes	600	98.1	9.57

Benecel E10M polymer Use Level = 1.00 wt% Active
Surfactant Use Level = 12.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	158	99.5	6.35
Ammonium laureth sulfate (1 EO)	Yes	26	99.4	6.53
Ammonium laureth sulfate (2 EO)	Yes	55	99.6	4.97
Ammonium laureth sulfate (3 EO)	Yes	509	99.9	5.62
Sodium lauryl sulfate	Yes	29	99.8	8.69
Sodium laureth sulfate (1 EO)	Yes	21	99.5	8.79
Sodium laureth sulfate (2 EO)	Yes	50	99.7	7.93
Sodium laureth sulfate (3 EO)	Yes	310	99.4	9.08
Cocamidopropyl betaine	Yes	609	98.7	5.52
Alkylpolyglucosides	No	—	—	—
Lauramine oxide	Yes	678	99.2	7.63
Sodium cocoamphoacetate	Yes	740	86.5	8.72
Disodium cocoamphodipropionate	Yes	996	97.3	9.66

Benecel™ K200M polymer Use Level = 0.50 wt% Active
Surfactant Use Level = 6.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	17	99.8	6.40
Ammonium laureth sulfate (1 EO)	Yes	69	98.1	6.59
Ammonium laureth sulfate (2 EO)	Yes	229	98.6	5.58
Ammonium laureth sulfate (3 EO)	Yes	533	99.0	5.76
Sodium lauryl sulfate	Yes	37	99.8	8.46
Sodium laureth sulfate (1 EO)	Yes	45	99.3	8.67
Sodium laureth sulfate (2 EO)	Yes	131	99.2	7.86
Sodium laureth sulfate (3 EO)	Yes	484	98.5	8.91
Cocamidopropyl betaine	Yes	542	98.9	5.41
Alkylpolyglucosides	Yes	502	40.2	10.70
Lauramine oxide	Yes	484	98.7	7.56
Sodium cocoamphoacetate	Yes	526	98.3	8.84
Disodium cocoamphodipropionate	Yes	724	97.0	9.72

Benecel K200M polymer Use Level = 0.50 wt% Active
Surfactant Use Level = 12.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	88	99.8	6.32
Ammonium laureth sulfate (1 EO)	Yes	168	95.7	6.59
Ammonium laureth sulfate (2 EO)	Yes	479	98.3	5.46
Ammonium laureth sulfate (3 EO)	Yes	798	99.2	5.76
Sodium lauryl sulfate	Yes	98	99.4	8.73
Sodium laureth sulfate (1 EO)	Yes	82	99.6	8.79
Sodium laureth sulfate (2 EO)	Yes	279	98.8	7.89
Sodium laureth sulfate (3 EO)	Yes	820	96.7	9.19
Cocamidopropyl betaine	Yes	698	91.7	5.47
Alkylpolyglucosides	No	—	—	—
Lauramine oxide	Yes	624	99.0	7.62
Sodium cocoamphoacetate	No	—	—	—
Disodium cocoamphodipropionate	Yes	532	91.6	9.73

Benecel K200M polymer Use Level = 1.00 wt% Active
Surfactant Use Level = 6.00 wt% Active

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	58	99.6	6.22
Ammonium laureth sulfate (1 EO)	Yes	848	95.8	6.53
Ammonium laureth sulfate (2 EO)	Yes	2,940	95.4	5.31
Ammonium laureth sulfate (3 EO)	Yes	6,800	96.0	5.62
Sodium lauryl sulfate	Yes	300	97.6	8.26
Sodium laureth sulfate (1 EO)	Yes	318	98.4	8.66
Sodium laureth sulfate (2 EO)	Yes	1,324	95.4	7.74
Sodium laureth sulfate (3 EO)	Yes	4,920	95.8	8.83
Cocamidopropyl betaine	Yes	6,620	96.1	5.49
Alkylpolyglucosides	Yes	2,112	12.6	10.69
Lauramine oxide	Yes	4,840	96.7	7.61
Sodium cocoamphoacetate	Yes	5,140	96.0	8.90
Disodium cocoamphodipropionate	Yes	7,720	94.9	9.65

**Benecel™ K200M polymer Use Level = 1.00 wt% Active
Surfactant Use Level = 12.00 wt% Active**

Surfactant	Compatibility	Viscosity (cps)	%T @ 600nm	pH as made
Ammonium lauryl sulfate	Yes	440	98.8	6.34
Ammonium laureth sulfate (1 EO)	Yes	1,532	96.3	6.58
Ammonium laureth sulfate (2 EO)	Yes	4,400	96.7	5.21
Ammonium laureth sulfate (3 EO)	Yes	9,340	97.2	5.72
Sodium lauryl sulfate	Yes	1,032	96.3	8.69
Sodium laureth sulfate (1 EO)	Yes	589	98.1	8.81
Sodium laureth sulfate (2 EO)	Yes	10,100	96.4	7.89
Sodium laureth sulfate (3 EO)	Yes	7,380	96.0	9.08
Cocamidopropyl betaine	Yes	6,620	77.2	5.53
Alkylpolyglucosides	No	—	—	—
Lauramine oxide	Yes	5,980	96.5	7.63
Sodium cocoamphoacetate	No	—	—	—
Disodium cocoamphodipropionate	Yes	3,160	81.1	9.70

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