

Water Activity and Growth of Microorganisms for Consumer and Pharmaceutical Products*

| | Range of a_w | Microorganisms Generally Inhibited by Lowest a_w in This Range | Consumer and Pharmaceutical Products Generally within This Range |
|---|----------------|---|---|
|  | 1.00–0.95 | Pseudomonas, Escherichia, Proteus, Shigella, Klebsiella, Bacillus, Clostridium perfringens, some yeasts | Antacid suspension, hair gel, anti-inflammatory ointment, chlorhexidine gel, cough syrup, topical cream, oral liquid suspension, shampoo |
|  | 0.95–0.91 | Salmonella, C. botulinum, Serratia, Lactobacillus, Pediococcus, some molds, yeasts (Rhodotorula, Pichia), Vibrio parahaemolyticus | Gel anti-inflammatory (topical use), laxative, neurotonic syrup, potassium gluconate (elixir) |
|  | 0.91–0.87 | Many yeasts (Candida, Torulopsis, Hansenula), Micrococcus | Anti-inflammatory suspension, cough suppressant, mucolytic elixir, nasal spray, oral liquid |
|  | 0.87–0.80 | Most molds (mycotoxigenic penicillia), Staphylococcus aureus, most Saccharomyces (bailii) spp., Debaryomyces | Anti-inflammatory cream, bactericidal cream, canker sore gel (oral), citrobioflavonoid and vitamin C syrup, epileptic syrup, lactulose syrup (laxative) |
|  | 0.80–0.75 | Most halophilic bacteria, mycotoxigenic aspergilli | High fructose corn syrup, soap (regular) |
|  | 0.75–0.65 | Xerophilic molds (Aspergillus chevalieri, A. candidus, Wallemia sebi), Saccharomyces bisporus | Topical ointment, soap (with glycerin) |
|  | 0.65–0.60 | Osmophilic yeasts (Saccharomyces rouxii), few molds (Aspergillus echinulatus, Monascus bisporus) | Honey |
|  | 0.60–0.50 | No microbial proliferation | Analgesic (gelatin capsules) liquid, analgesic (gelatin capsules) gelatin, anti-mycotic powder |
|  | 0.50–0.40 | No microbial proliferation | Analgesic, anti-allergic, antibiotic pills (cefacillin), anti-migraine pills, aspirin, cough drop (liquid center), dry powder inhaler, pancreatin tablets |
|  | 0.40–0.30 | No microbial proliferation | Compressed tablet, lip balm, liquid-filled capsule, powder-filled capsule, soft-gel liquid-filled capsule, multivitamin tablets, vitamin C tablets |
|  | 0.30–0.20 | No microbial proliferation | Hard shell capsule, rectal suppositories, rectal ointment |
|  | <0.10 | No microbial proliferation | Propellant-based metered dose inhaler |

* Adapted from Water Activity Applications in the Pharmaceutical Industry