

## Microorganism Growth According To Water Activity

"Water Activity of Some Foods and Susceptibility to Spoilage by Microorganisms" - Adapted from Beuchat (1981)

$a_w$	Microorganisms generally <b>inhibited</b> by $a_w$ at this point	Examples of foods within this range of water activity.
0.950	<i>Pseudomonas</i> , <i>Escherichia</i> , <i>Proteus</i> , <i>Shigella</i> , <i>Klebsiella</i> , <i>Bacillus</i> , <i>Clostridium perfringens</i> , some yeasts	Highly perishable foods (fresh and canned fruits, vegetables, meat, fish) and milk; cooked sausages and breads; foods containing up to 4oz (w/w) sucrose or 7%NaCl
0.910	<i>Salmonella</i> , <i>Vibrio parahaemolyticus</i> , <i>C. botulinum</i> , <i>Serratia</i> , <i>Lactobacillus</i> , <i>Pediococcus</i> , some molds, <i>Rhodotorula</i> , <i>Pichia</i>	Some cheese (Cheddar, Swiss, Muenster, Provolone); cured meat (ham); some fruit juice concentrates; foods containing 55%(w/w) sucrose or 12%NaCl
0.870	Many yeasts ( <i>Candida</i> , <i>Torulopsis</i> , <i>Hansenula</i> ), <i>Micrococcus</i>	Fermented sausage (salami); sponge cakes; dry cheese; margaring; foods containing 65% (w/w) sucrose (saturated) or 15%NaCl
0.800	Most molds (mycotoxigenic penicillia), <i>Staphylococcus aureus</i> , most <i>Saccharomyces (baillii) spp.</i> , <i>Debaryomyces</i>	Most fruit juice concentrates; sweetened condensed milk; chocolate syrup; maple and fruit syrups; flour; rice; pulses containing 15-17% moisture; fruit cake; country style ham; fondants; high-sugar cakes
0.750	Most halophilic bacteria, mycotoxigenic aspergilli	Jam, marmalade; marzipan; galcé fruits; some marshmallows
0.650	Xerophilic molds ( <i>Aspergillus chevalieri</i> , <i>A. Candidus</i> , <i>Wallemia sebi</i> ), <i>Saccharomyces bisporus</i>	Rolled oats containing ~10% moisture; grained nougats; fudge marshmallows; jelly; molasses; raw cane sugar; some dried fruits; nuts
0.600	Osmophilic yeasts ( <i>Saccharomyces rouxii</i> ), few molds ( <i>Aspergillus echinulatus</i> , <i>Monascus bisporus</i> )	Dried fruits containing 15-20% moisture; some toffees and caramels; honey
0.500	No microbial proliferation	Noodles, spaghetti, etc. containing ~12% moisture; spices containing ~10% moisture
0.400		Whole egg powder containing ~5% moisture
0.300		Cookies, crackers, bread crusts, etc. containing 3-5% moisture
0.030		Whole milk powder containing 2-3% moisture; dried vegetables containing ~5% moisture; corn flakes containing ~5% moisture; dehydrated soups; some cookies and crackers

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