



# Water activity and toxins

## Minimum $a_w$ for growth and mycotoxin production

Mycotoxin	Mold	Minimum $a_w$	
		Growth	Toxin production
Aflatoxin	<i>Aspergillus flavus</i>	0.78 - 0.84	0.84
			0.83 - 0.87
Ochratoxin	<i>A. parasiticus</i>	0.82	0.87
	<i>A. ochraceous</i>	0.77 - 0.81	0.83 - 0.87
Penicillic acid	<i>Penicillium cyclopium</i>	0.82 - 0.85	0.87 - 0.90
	<i>P. viridicatum</i>	0.80 - 0.81	0.83 - 0.86
	<i>A. ochraceous</i>	0.77	0.80 - 0.88
Patulin	<i>P. cyclopium</i>	0.82 - 0.85	0.97
	<i>P. marenzii</i>	0.79	0.99
	<i>P. patulum</i>	0.81 - 0.85	0.95
Stachybotryn	<i>P. expansum</i>	0.82 - 0.84	0.99
	<i>Stachybotrys atra</i>	0.94	0.94



# Water activity calculations

- <http://www.users.bigpond.com/webbtech/wadload.html>



## Example 1

- Your company just completed development of a new super water binding agent. You are asked to collect some data to be used in a technical brochure as to its water binding properties. It will be promoted for baked cereal products such as cookies and crackers as a major competitor for oat bran. You have the following data from the standard static desiccator method.



## Example 1 cont.

Salt	Aw	pan weight g	wt initial g	wt final g
LiCl	0.116	3.84168	4.85064	4.90759
MgCl <sub>2</sub>	0.331	3.90058	4.90004	5.04579
K <sub>2</sub> CO <sub>3</sub>	0.445	3.78457	5.0753	5.32094
Mg(NO <sub>3</sub> ) <sub>2</sub>	0.54	3.74701	5.03955	5.3639
NaNO <sub>2</sub>	0.665	3.84532	5.19294	5.62567
NaCl	0.75	3.77085	5.24571	5.82968
BaCl <sub>2</sub>	0.88	3.6421	5.2753	6.47804
K <sub>2</sub> SO <sub>4</sub>	0.978	3.73253	4.80209	6.40414

Initial moisture 4.44% water (wb)



## Example 2

- The following data for the wet basis moisture content of corn flakes and raisins at 23°C were obtained. It is proposed to make a cereal mix with a blend of 20% fruit.

water activity	Raisin % water (wb)	Corn Flakes % water (wb)
0.113	7.59	1.32
0.22	8.91	2.21
0.33	9.62	3.81
0.45	12.22	6.01
0.54	15.61	7.45
0.77	28.37	17.1
0.89	45.18	24.2
Initial moisture (%)	17.3	1.5



## Example 2 cont.

- Create an isotherm for:  
corn flakes, raisins and mix
- What water activity would they reach if equilibrium occurred in the package?
- Raisins get hard below 0.44 aw and bran loses crunchiness above an aw of 0.4. Is there a problem with this mixture and how would you solve it?