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Data Article

# Dataset of water activity measurements of alcohol:water solutions using a Tunable Diode Laser

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ABSTRACT

The data presented in this article are related to the research article entitled "RH-temperature phase diagrams of hydrate forming deliquescent crystalline ingredients" (Allan and Mauer, 2017) [1]. The data are water activity measurements of alcohol:water solutions (methanol:water and ethanol:water solutions at varying molar ratios) at different temperatures collected using the Tunable Diode Laser by Decagon Devices. The measured water activities of ethanol:water solutions were correlated to the initial volumetric ratios to produce polynomial equations that can be used to calculate the needed initial volumetric ratios for water activity controlled solutions. The data sets and polynomial equations are provided to enable extended analyses and applications of the data and calculations for generating and using controlled water activity solutions containing alcohol. An example application of these data is described in the research article mentioned above.



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**Specifications Table**

| Subject area | Food Chemistry |
|---|---|
| More specific subject area | *Physical food chemistry, water activity, phase diagrams, materials science* |
| Type of data | *Tables, Figures* |
| How data was acquired | *Water activity measurements collected using a Tunable Diode Laser instrument (Decagon Devices, Pullman, WA)* |
| Data format | *Raw, Analyzed* |
| Experimental factors | *Volumetric ratios of alcohols and water were mixed, equilibrated, and the water activities were measured using the Tunable Diode Laser by Decagon Devices.* |
| Experimental features | *The effects of alcohol type, molar ratio, and temperature on the measured water activity of alcohol-water solutions* |
| Data source location | *Purdue University Department of Food Science, West Lafayette, Indiana, USA* |
| Data accessibility | *The data are available within this article* |

**Value of the data**

- The water activities of alcohol solutions were measured using a new method that is able to measure the water activity in the presence of volatiles.
- The validity of the Tunable Diode Laser method is supported because the measured water activities are comparable to values previously reported of similar solutions.
- Polynomial equations were generated from the data to calculate initial volumetric ratios of ethanol–water solutions to produce precise water activity controlled solutions.
- Temperature appears to have a minor effect on the water activity of ethanol–water solutions at 20, 25, and 30 °C, and thus the data should be applicable to a range of temperatures.
- This data allows other researchers to generate water activity controlled solutions to extend their applications.

## 1. Data

The water activities of alcohol:water solutions were measured using a new water activity ($a_w$) measurement method, and all data are provided in Tables 1 and 2. The water activities of ethanol:water and methanol:water solutions at varying molar ratios were compared to the reported calculated $a_w$ methanol:water solutions [2,3] and the water activity of an ideal solution according to Raoult's law [4] in Fig. 1. Molar ratios were converted to initial volumetric ratio then compared to the measured water activity (Fig. 2, and Tables 1 and 2). Polynomial equations were generated to calculate the volumetric ratio of ethanol to water to make water activity-controlled solutions as mentioned in *RH-temperature phase diagrams of hydrate forming deliquescent crystalline ingredients* [1].
The effects of temperature on the water activity of ethanol:water solutions are shown in Fig. 3.

## 2. Experimental design, materials and methods

Ethanol:water and methanol:water solutions were mixed at periodic volumes, equilibrated overnight, and the water activity was measured. Due to the volatility of the alcohols, the water activity of the solutions was measured using the Tunable Diode Laser $a_w$ measurement device operating with software version S4TDL-R2-12 (Decagon Devices, Pullman, WA). The Tunable Diode Laser measures