The Effectiveness of Commercial Desiccants and Uncooked Rice in Removing Moisture from Hearing Aids

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Introduction
According to the World Health Organization (2004), over 275 million people globally have hearing loss, with 80% from low- and middle income countries. Use of hearing aids in young children can provide access to sound, essential for the development of spoken language. To be effective, hearing aids must be in optimal working order on a consistent basis. Hearing aid repairs can be costly and difficult to access.

Hearing aids are susceptible to moisture damage, particularly in regions with high levels of relative humidity (RH). Moisture-induced corrosion in hearing aids is a leading cause of hearing aid malfunction.

Commercial desiccants made of silica gel are commonly used to draw moisture from hearing aids. Silica gel absorbs moisture by attracting water molecules and binding them to the silica gel surface.

In many parts of the world, commercial desiccants are not readily available and hearing aid users are commonly advised to place the hearing aid into a container of uncooked rice. Anecdotally, rice is viewed as a viable alternative to commercial desiccants to absorb moisture from inside the hearing aid. Empirical support for this recommendation could not be found in a search of the literature. Further, published reports documenting the effectiveness of traditional desiccants in removing moisture from hearing aids are largely unavailable.

Study Questions
1. Is there variability in the effectiveness of commercial silica gel desiccants for removing moisture from water-saturated hearing aids?
2. Is uncooked white and brown rice just as effective in removing moisture from hearing aids as commercial silica gel desiccants?

Materials Used
- Campbell Scientific relative humidity sensor (model: CS215-L) (see Figure 1).
- Data logger (model: CR200) and a laptop computer (see Figure 2).
- Campbell Scientific data analysis software (PC200W).
- A test chamber to ensure a consistent and stable test environment (see Figure 3).
- Starkey A-13 Sequel hearing aid
- Commercially available silica gel desiccants (listed alphabetically)
  - Dri-Eze HA Dehumidifier
  - Hal-Hen HA Dehumidifier
  - Hal-Hen Mini
  - Hal-Hen Mini Super
  - Siemens Stay Dri
  - Westone Hearing Aid Saver
- Uncooked white and brown rice

Method
Systematic procedures were followed to evaluate the effectiveness of 7 commercially available desiccants, uncooked white rice, and uncooked brown rice in removing moisture from water-saturated hearing aids.

All data were collected using a RH sensor in a temperature-controlled environment. The room temperature remained constant between 66-75°F.

Test Procedures:
1. Record the temperature, time, and relative humidity (RH) of the room and the test chamber
2. Verify that the room temperature is ±2°F compared with the test chamber temperature
3. Verify that the room RH is within ±2% compared with the test chamber RH
4. Submerge hearing aid for 60 seconds in room temperature water
5. Place hearing aid into test chamber for 3 hours to obtain RH measurements of saturated hearing aid
6. Take hearing aid out of the test chamber and place it in the desiccant or rice treatment for 8 hours
7. Remove hearing aid and record the temperature, time, and relative humidity of the room and the test chamber
8. Verify that the room temperature is ±2°F compared with the test chamber temperature
9. Verify that the room RH is within ±2% compared with the test chamber RH
10. Place hearing aid into the test chamber for 3 hours to obtain RH measurements after desiccant or rice treatment

Conclusions and Future Research
Optimal hearing aid function is essential for young children to develop listening and spoken language skills. Effective methods to minimize the need for hearing aid repairs due to moisture damage would be a positive benefit to children and families, particularly in developing countries where access to hearing aid repair options may be limited.

Preliminary findings from the current study indicate that variability exists in the effectiveness of commercial gel silica desiccants in removing moisture from hearing aids; and that the use of uncooked rice is statistically significantly less effective than use of the best gel silica desiccants.

Additional testing is underway to replicate findings and to explore alternative methods for removing moisture from gel silica desiccants in regions where families may not have access to microwaves or traditional ovens to remove moisture from the desiccant.

Results
All commercial desiccants were somewhat effective in removing moisture from hearing aids, but there was a statistically significant difference between desiccant types, F (2,9) = 2.57, p = .038. The Hal Hen Mini Super was the most effective, followed by the Siemens Stay Dri, and the Westone Hearing Aid Saver.

Use of uncooked brown rice and uncooked white rice was not as effective as gel silica desiccants in removing moisture from hearing aids.

Hearing aids submerged in water and then placed on a table top for eight hours, with no desiccant treatment, showed similar RH levels as hearing aids placed in uncooked rice. However, this measure did not account for how quickly moisture was removed.

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<tr>
<th>Type of Desiccant</th>
<th>Mean</th>
<th>Std. Error</th>
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<td>22.480</td>
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<td>Dri-Eze HA Dehumidifier</td>
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<td>Siemens Stay Dri</td>
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<td>21.142 - 35.451</td>
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<td>White Rice</td>
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<td>Brown Rice</td>
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<td>37.380</td>
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Tests of Between-Subjects Effects

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