

Human excrement efficiently converted to hydrochar

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Researchers from Ben-Gurion University of the Negev (BGU) demonstrated for the first time that raw human excrement can potentially be converted to a safe, reusable fuel and a nutrient rich fertilizer, solving two major worldwide issues in advance of World Toilet Day on November 19.

According to the groundbreaking pilot study published in the *Journal of Cleaner Production*, researchers at BGU's Zuckerberg Institute for Water Research have refined a process using hydrothermal carbonization (HTC) to heat raw solid [human waste](#) in a designated "pressure cooker" and convert excreta into hydrochar: a safe, reusable biomass fuel resembling charcoal.

The BGU researchers conducted similar research last year on poultry excrement.

The discovery addresses two challenges prevalent in the developing world: sanitation and growing energy needs. While access to [waste](#) treatment worldwide has expanded significantly in recent years, approximately 2.3 billion people still lack basic sanitation services, according to the World Health Organization. Of those, 892 million people—mostly in rural areas—defecate in the open. The Bill & Melinda Gates Foundation sees sanitation as a major world health issue and has launched the Reinvent the Toilet Challenge & Expo to address this problem.

"Human excreta are considered hazardous due to their potential to transmit disease," says Prof. Amit Gross, who is the newly appointed director of the Zuckerberg Institute. "While it is rich in organic matter nutrients such as nitrogen, phosphorus and potassium, human waste also contains micro pollutants from pharmaceuticals, which can lead to environmental problems if not disposed or reused properly."

Energy scarcity is also a challenge in these regions. Approximately two billion people worldwide use solid biomass, especially wood, which is converted into charcoal and then used for cooking and heating. But these practices also leave a footprint on the environment: air pollution, greenhouse gas emissions, deforestation, and soil erosion.

"By treating human waste properly, we can address both of these issues at once," Prof. Gross says.

In the study, the researchers subjected the raw waste through HTC to three temperatures (180, 210 and 240° C) and reaction times (30, 60 and 120 minutes). The solids become dehydrated, creating a combustible solid substance known as hydrochar, as well as a nutrient-rich aqueous phase liquid.

The researchers, including doctoral candidates Reut Yahav Spitzer and Vivian Mau, said the reaction that creates the hydrochar sterilizes the waste material, so it becomes safe to handle. The "coals" can potentially be utilized for household heating and cooking, while the liquid byproduct (the aqueous phase) could be used as fertilizer.

More information: Reut Yahav Spitzer et al, Using hydrothermal carbonization for sustainable treatment and reuse of human excreta, *Journal of Cleaner Production* (2018). [DOI: 10.1016/j.jclepro.2018.09.126](https://doi.org/10.1016/j.jclepro.2018.09.126)

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