Products from Wastewater & Water



Our bodies are not **100%** efficient at converting food energy into mechanical output. But at about 25% efficiency, we're surprisingly good considering that most cars are around 20%, and that an lowa cornfield is only about 1.5% efficient at converting incoming sunlight into chemical storage.

Where does the other 75% Go???

Americans use 5.7 billion gallons per day from toilet flushes. REMEMBER THEY CAN'T FL__H WITHOUT US



According to calculations by the environmental biotechnologist <u>Willy Verstraete</u>, every 1000 gallons of waste water contains the <u>equivalent of \$1.88 worth</u> of fertilizers, organic matter, energy-producing gases and more.

For Every 1,000 gallons of sludge @ 3% solids and 68% volatility



There is \$3.06 in biogas @ (\$5.00/1,000Ft3) and \$4.80 in electricity @ (\$0.07/KWH) **Cranfield University** is developing the **Nano Membrane Toilet** which will be able to treat human waste on-site without external energy or water. The **Cranfield toilet** is designed for single-household use (equivalent to 10 people) and will accept urine and faeces as a mixture.





What is Supercritical Water ?



For those of you not familiar with supercritical water oxidation, the basic premise is that once water goes above 370 Deg C or (698 F) and 220 Bar of pressure(3,190 psi), it enters a fourth state, referred to as supercritical. If you introduce oxygen into supercritical water, you can completely oxidize organic material. This releases energy which can be used in a CHP plant and produces an inert ash-like material and water (supernatant) with a COD of less than 5mg/l.





Is this what they mean by Russian Hacking?

A group of businessmen from Washington show a big interest for The Russian Company "Cheloveckaja Energija" developer of a technology which is turning a human waste into energy! The whole idea is human waste to be collected, fats and oils to be extracted and to be used for a production of biodiesel. The side products can be used as a cheap and eco friendly fertilizer for the soil.

Most of the energy experts agree that: if this technology shows a positive result this can be a beginning of a new era for humanity.



Average person emits 75cc CH₄/Fart or 0.0025486 Ft3

<u>127Ft3 geg</u> = 49,831 Farts=1 gal. of gas

... HM.

0.0025486

Google says we average 10 to 20 farts/D 49,831/15 = 3322 days or 9.1 years



Urine turned into hydrogen fuel

US researchers have developed an efficient way of producing hydrogen from urine - a feat that could not only fuel the cars of the future, but could also help clean up municipal wastewater.

Using hydrogen to power cars has become an increasingly attractive transportation fuel, as the only emission produced is water - but a major stumbling block is the lack of a cheap, renewable source of the fuel. *Gerardine Botte of Ohio University* may now have found the answer, using an electrolytic approach to produce hydrogen from urine - the most abundant waste on Earth - *at a fraction of the cost of producing hydrogen from water.*



How many liters of urine are produced every day in the world? This seemingly gross question may very well hold the answer to fuel crisis that we all are facing. Approximately, 10.5 billion liters (2.77 billion gallons) of urine are produced every day which is (for comparison's sake) enough to fill above 4,000 Olympic sized swimming pools. This much amount goes to waste every day, but, now scientists are hoping that they can use this to generate power; power for homes, cities and vehicles.

Imagine powering your home with waste bi-products. You could essentially power your home with pee. Adult human being produces 1-2 liters of urine per day. 1 liter is enough to power a small generator for 6 hours. How do we know this? A 14 year old girl and her friends from Nigeria, Africa created a system that separates the hydrogen and oxygen in urine, purifies the hydrogen and uses it to power a generator.



The system works like this:

Urine is put into an electrolytic cell, which separates out the hydrogen.

The hydrogen goes into a water filter for purification, which then gets pushed into the gas cylinder.

The gas cylinder pushes hydrogen into a cylinder of liquid borax, which is used to remove the moisture from the hydrogen gas.

This purified hydrogen gas is pushed into the generator.

PRACTICE YOUR AIM



Hydrogen Fuel Cell Vehicle

THINK OF THE POSSIBILITIES



They have OPEC **Organization of Petroleum Exporting Countries** WE Have: **OPISS** Ohioans Peeing In Selective **Sewers**

From Dr. Botte's Green Box to Mike's Vial

2.4 gallons $H_2O = 1 \text{ Kg } H_2$

פפט-1000

One kilogram of H**2** has approximately the same energy as one gallon of gasoline.





Urine consists of approximately 98% wate

BINALYS

and 2% urea, which is made up of cark oxygen, nitrogen and <mark>hydrogen atom</mark>s

Urochrome is a pigment which gives your urine a yellow color.

OOPS

You Wanted to Know

• 9 liters of urine produces 1 kg of hydrogen

- One kilogram of H₂ has approximately the same energy as one gallon of gasoline.
- Average Adult Human Being produces 1 to 2 liters of urine per day – So 9 liters/1.5 liters/Day = 6 Days to produce the equivalent of one (1) gallon of gasoline.

Remember the 10.5 billion liters/D that's 1,166,666,666 gals. gas

Cow Urine Can Sell for More Than Milk in India



India to launch cow urine as soft drink

Does your Pepsi lack pep? Is your Coke not the real thing? India's Hindu nationalist movement apparently has the answer: a new soft drink made from cow urine.

The bovine brew is in the final stages of development by the Cow Protection Department of the Rashtriya Swayamsevak Sangh (RSS), India's biggest and oldest Hindu nationalist group, according to the man who makes it.

Om Prakash, the head of the department, said the drink – called "gau jal", or "cow water" – in Sanskrit was undergoing laboratory tests and would be launched "very soon, maybe by the end of the year. It won't be like carbonated drinks and would be devoid of any toxins.



MOO Over Mountain Dew



Diseases cured by Cow Urine

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- TUMOUR PILES PROSTATE ENLARGEMENT CALCULUS BONE FRACTURE DIABETES OPIUM POISON FLATULENCE, GASES CONSTIPATION
- DYSPEPSIA
- INDIGESTION
- · DIARRHOEA

EPILEPSY VERTIGO ANOREXIA

- HERNIA
- ACIDITY
- APPENDICITIS
- DISORDER OF
- DUCTLESS GLANDS.
- CANCER



You're in Luck Today



Did You know that Urine is used to make Gunpowder?

- Gunpowder is made up of these ingredients:
- 75% Potassium Nitrate
- 15% Charcoal
- 10% Sulfur

Guess where the KNO₃ comes from?

Traditionally, **gunpowder** used in **fireworks** was **made** of 75 percent potassium nitrate (also called saltpeter) mixed with 15 percent charcoal and 10 percent sulfur; modern **fireworks** sometimes use other mixtures (such as sulfurless powder with extra potassium nitrate)





How urine will get us to Mars

A new recycling system turns pee into drinking water and energy



DRINK UP Astronauts drink water made from recycled urine and other wastewater aboard the International Space Station. A new system would turn pee into drinking water and produce energy, a step toward long-term space travel







Over your lifetime you'll eat about 60 tons of food. And all of that food will ultimately pass through your GI tract.



What you may not realize is that your GI tract is home to a lot more than what you ate for breakfast this morning.



Your GI tract is also home to a thriving population of approximately 100 trillion microbes like bacteria, fungi, and viruses

Hippocrates – "All Disease Begins In The Gut"



A new clinical trial -- which is not yet open to participants -- will study the effects of gut microbes from lean, metabolically healthy donors on the bodies of people with obesity and/or insulin sensitivi**Now How Healthy does that person Look ?** To get the microbes from one person to the other, scientists will freeze the feces from donors and case the material into pills, to be taken orally by the subjects.



Massachusetts General Hospital Recommended: not to chew



Coffee Luwak

Brewed from beans excreted by Asian palm civets

- Sells for up to \$800 per kilogram \$363.00/Lb.
- Selection of ripe coffee beans
- Partial digestion said to strip bitterness from taste

Asian palm civet

- Habitat: tropical forest
- Range: India, China, Vietnam, Malaysia, Indonesia, Philippines
- Mostly tree dwelling
- IUCN status: least concern

Source: AnimaldiversityWeb

Paradoxurus hermaphroditus Length: about 53 cm Weight: Up to 5 kg



Wastewater Engineer makes beer from Milwaukee's Metropolitan Sewer District's final effluent, called:

ACTIVATED SLUDGE



That beer grabbed relatively high marks when presented to a tasting panel at Milwaukee's Lakefront Brewery. In the beer's defense, brewery President Russ Kilsch even said, "No pathogen known to man...can grow in beer." Sounds like people are certainly putting that theory to the test.
Japanese Scientists Create Meat From Poop



They call it POOP STEAK – no kidding

Mitsuyuki Ikeda, a researcher from the Okayama Laboratory, has developed steaks based on proteins from human excrement. Tokyo Sewage approached the scientist because of an overabundance of sewage mud(shit). They asked him to explore the possible uses of the sewage and Ikeda found that the mud contained a great deal of protein because of all the bacteria.

The researchers then extracted those proteins, combined them with a reaction enhancer and put it in an exploder which created the artificial steak. The "meat" is 63% proteins, 25% carbohydrates, 3% lipids and 9% minerals. The researchers color the poop meat red with food coloring and enhance the flavor with soy protein. Initial tests have people saying it even tastes like beef.



IF YOU LOSE TO OHIO STATE



IF YOU LOSE TO ALABAMA



POST GAME MEALS











The food that will sustain future generations as we colonize our way across space may be none other than our own sh*t, if a new NASA-funded project is successful. The US space agency has allocated researchers at *Clemson University* in South Carolina US\$200,000 a year for up to three years to figure out how to recycle human faeces into synthetic food that could sustain astronauts during extended journeys or on a Martian colony. *Or Post Game Meals* That's my take

Can Artificial Meat Save The World?

The ability to efficiently create meat, or something sufficiently meat-like, will become progressively more important in coming years because humanity may be reaching a point when there's not enough animal protein to go around. The United Nations expects the global population to grow from the current 7.2 billion to 9.6 billion by 2050. Also, as countries such as China and India continue to develop, their populations are adopting more Western diets. Worldwide the amount of meat eaten per person nearly doubled from 1961 to 2007, and the UN projects it will double again by 2050.

Each year, Americans eat more than 200 pounds of meat per person.

- For example, a single pound of cooked beef, a family meal's worth of hamburgers, requires 298 square feet of land, 27 pounds of feed, and 211 gallons of water.
- As ghoulish as growing lab meat sounds, the concept has a long history, and not just in science fiction. In 1931, Winston Churchill wrote, "Fifty years hence, we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium."

Beyond Meat Factory - 1985

in Columbia, Missouri, food scientists transform a mix of soy and pea proteins and amaranth into "chicken" strips.





"R" World Is Changing

We use to say:

"This taste like Shit"

In The Future:

You'll be paying them a compliment

Your mate farts



And you say:

Supper smells delicious!

Your mate says "I'm constipated"



And you say: Is there anything else to eat?

MANGOMATERIALS

From Methane to Bioplastic: Challenges of Engineering and Fermentation at Scale

Ailison Pieja, Ph.D., CTO <u>Ailison@MangoMateriais.com</u>

Anne Schauer-Gimenez, Ph.D., VP of Customer Engagement Anne@MangoMaterials.com

16 February 2017







TN1: the right microbe to do the job

- Can use VFAs as food.
- Makes LOTS of hydrogen and PHA.
- Can grow aerobically and anaerobically.





IF THE METHANE FROM U.S. WATER RESOURCE RECOVERY FACILTIES IS USED TO MAKE MANGO MATERIALS' BIOPLASTIC:

MORE THAN 250 MILLION POUNDS OF BIOPLASTIC WOULD BE PRODUCED EACH YEAR. IF THE COLLECTED BUT UNUSED METHANE FROM U.S. LANDFILLS IS USED TO MAKE MANGO MATERIALS' BIOPLASTIC:

3 BILLION POUNDS OF BIOPLASTIC WOULD BE PRODUCED EACH YEAR.

Total Sales Per Pound of Methane



Integration at wastewater treatment facilities

Verify process on biogas (vs. pure methane)



Pilot-scale operation



Good news!





PHA bottle biodegradation over a period of 2 months.

CLOSED LOOP BIOPRODUCT ECONOMIES ARE NOW POSSIBLE

- LET'S BUILD ONE!

Decentralized Production





Stanford engineers use rocket science to make wastewater treatment sustainable

Researchers encourage bacteria that produce nitrous oxide and methane in sewage sludge. The gases can then be cleanly burned to produce energy to run the plant.

Nitrosomonas europaea appears to produce N₂O by more than one mechanism. Moderate amounts are released under full aeration, but the release increases sharply in response to oxygen limitation. Poth and Focht showed that *N. europaea* denitrified with NO_2^{-} as the electron acceptor and that the labelling pattern observed (with either¹⁵NH $_{4}$ + or¹⁵NO₂⁻) indicated that N₂O was primarily a product of NO₂⁻ reduction, rather than a by-product of NH₃ oxidation. The presence of nitrite reductase in *N. europaea* has been demonstrated in several investigations and it is probably involved in the production of N₂O by this organism under oxygen-limiting conditions





and the state of the

For racing purposes, nitrous oxide is usually contained in an aluminium cylinder; available in a variety of sizes ranging from 2.5 lbs to 20 lbs. While retained in the cylinder the nitrous is in a liquid form and held under high pressure. When it is released from the cylinder into the intake tract its physical state changes from a liquid to a gas. This transformation occurs as the nitrous is released from an area of extreme pressure (the aluminium cylinders are pressurized to approximately 1000 P.S.I.) into the vacuum of the intake manifold. This change in state is usually referred to as the nitrous 'boiling'.







Methanol, also known as methyl alcohol, is often abbreviated as MeOH.

Biochemical pathways

One biochemical route is via methane formation by anaerobic digestion. This process is well developed due to the rise of biogas production from municipal waste or landfill sites.

The biogas has to be cleaned to obtain a gas with high methane content and MeOH is then produced from the methane as described above.

Recently a genuine biochemical route using methanothrophic bacteria has been investigated. For example, bacteria such as *Methylococcus capsulatus* will convert methane to MeOH if methane is the only available resource.

Maverick Synfuels, a leader in alternative fuels and chemicals production technology, and Plant Process Equipment Inc., a global energy engineering and fabrication company, have formed a partnership to manufacture and sell small-scale gas-toliquids (GTL) methanol plants. These skidmounted modular plants can be rapidly deployed and are capable of producing between 3,000 - 10,000 gallons per day of ultra-clean synthetic fuels and chemicals from natural gas or methane-rich "waste gas."





If you produce 100,000 gallons of sludge/Day

100,000 gallons x 8.34 x 0.04 x 70%= 23,352 Lbs. Volatile solids Destroy 55% by Anaerobic Digestion= 12,843 Lbs. Destroyed 12,843 Lbs. x 15 Ft^3 / Lb. Destroyed= 192,645 Ft³ *NEED 186,000*Ft³

To make 3,000 to 5,000 gallons of Methanol/Day *That's a 33.0 to 35.0 MGD activated sludge Plant*.

•Here are just some types of materials that are made from methanol:

- **Plastics**
- •Synthetic fibers
- Paints
- •Resins
- Magnetic film
- Safety glass laminate
- Adhesives
- Solvents
- Carpeting
- Insulation
- Refridgrants
- •Windshield washer fluid
- Particle board
- •Pigments and dye

SCIENTIFIC

Why us, why now?

We address a growing environmental problem with game-changing technology and an experienced team



Dunaliella salina algae



AND GLYCEROL FEED ON BRINE

Management Team

Paul Horst (CEO). Jim Fahrner (CFO)

- Founded industrial computer company, 9x cash over cash exit in 3 years, later spun off as NASDAQ company
- Grew alternative energy subsidiary of DTE Energy to over \$40M

Geoff Horst (CSO), Robert Levine (CTO)

- Developed Algal's patent-pending treatment process
- PhD candidates in biology and chemical engineering

Mike Maringer, James Bleyer (operations, engineering)

- Managed Campbell Soup's largest wastewater treatment plant (10 million gallons per day), highest certification
- Designed and built bio-fuel plants

Notable Advisors: Joh Kang, Walter Weber

- PhD, VP & Director of water at Tetra Tech
- PhD, Professor Emeritus, U. Michigan

Engineering Partners

Alan Environmental – John Baker








Took an idea (new way to treat wastewater), built and operated the pilot units, sold the concept to Anheuser-Busch and now have a full scale system treating nearly 2 million gallons per day

124

What is Beta Glucan? It is not a vitamin! Beta glucans belong to class of carbohydrates called polysaccharides. Beta Glucan is a fiber-type of sugar that come from the cell walls of yeasts, algae and other microorganisms.



3D structure of cellulose, a beta-glucan polysaccharide.



Nature's Secret



Vaclay Vervicka, Ph.D.

- Beta-1,3-D glucan Clinical Applications
- Cancer
- Elavated Cholesterol
- Prevention of Infection
- Raditation Exposure
- Septic Shock
- Surgery

Wound Healing

Stimulates the Immune System





ALGAMUNE

High potency beta glucan for Animal Health

A Little Closer to Home



MillerCoors[™] Trenton, Ohio Mater Reclamation Center Water Reclamation Center









© Amy's Cooking Adventures

Could we make meat out of this protein?



Our Vision & Mission

Our vision is to lead a change in the perception of wastewater, transforming it from a burden to a valuable commodity;

Transforming wastewater treatment plants into wastewater recycling plants Applied CleanTech Converting Sewage into an Economic Asset





waste water treatment

Bacterial cellulose is an <u>organic compound</u> with the formula (<u>C6H10O</u>5)

produced by certain types of <u>bacteria</u>. While <u>cellulose</u> is a basic structural material of most plants, it is also produced by bacteria, principally of the

genera Acetobacter, Sarcinaventriculi and Agrobacterium.

Bacterial, or microbial, cellulose has different properties from plant cellulose and is characterized by high purity, strength, moldability and increased water holding ability.^[1] In natural habitats, the majority of bacteria synthesize extracellular <u>polysaccharides</u>, such as cellulose, which form protective envelopes around the cells



Biomass 400X

7200X









SRS: Sewage Recycling System

We offer a unique and effective technology that Based on proven proprietary wastewater-recycling At Applied CleanTech, we developed a unique, pre-treats wastewater in its early stages, before technology, our sewage mining solution (SRS) innovative solution that automatically produces a sludge is formed. Our patented proven SRS automatically extracts cellulose out of raw usable, valuable and revenue-generating commodity sewage mining technology recycles sewage solids, wastewater and turns it into a valuable revenue- from wastewater. Wastewater treatment plants thus creating a commodity that is high in demand. generating commodity: Recyllose™ (recycled (WWTPs) can now become manufacturers of The SRS technology treats the sludge problem cellulose). Recyllose™ has numerous applications RecylloseTM- a valuable recycled cellulose-based before it occurs by reducing sludge formation by up in various industries, including construction, product from wastewater. to 50% and significantly decreases sewage-related insulation, pulp & paper, and bio-plastics, can be Our technology significantly reduces sludge formation health hazards and treatment costs.

Recyllose™ : Revenue-Generating Resource Changing the Way We Handle Wastewater

friendly fuel source, and more.

used as an economical and environmentally- by extracting cellulose out of raw wastewater. By doing so, we save costs and energy consumption to WWTPs throughout the entire process, as well as increase WWTp's capacity and reduce greenhouse gas (GHG) emissions & carbon footprint.

Our Demand for Water



It takes 5,670 litres (1,500 gal) of water to process one barrel of beer

454 litres (120 gal) of water are used to produce one egg

It takes 45 litres (12 gal) of water to process one chicken

147,000 litres (39,000 gal) of water are used to manufacture one new car

About 25,700 litres (6,800 gal) of water is required to grow a day's food for a family of 4

It takes 7,000 litres (1,850 gal) of water to refine one barrel of crude oil

Did You Know?

Approximately 75% of the human body consists of water. Water exists within all our organs and it is transported throughout our body to assist physical functions. The total amount of water in the body of an average adult is 9.77 gallons. Human brains are 75% water. Human bones are 25% water. Human blood is 83% water. 75% of a chicken is water. 80% of a pineapple is water. 95% of a tomato is water. 70% of an elephant is water. Each day the sun evaporates a trillion tons of water – or lifting the world's population (2.05 billion, 180#/cap. -

6504 times/day)

Water's effect on the Body

H₂Ohio

Moistens tissues such as those in the mouth, eyes and nose

Protects body organs and tissues

Helps prevent constipation

> Helps dissolve minerals and other nutrients to make them accessible to the body

Regulates body temperature

Lubricates joints

Lessens the burden on the kidneys and liver by flushing out waste products

Carries nutrients and oxygen to cells

OUR BODIES AND WATER

Water flows through the blood, carrying oxygen and nutrients to cells and flushing wastes out of our bodies. It cushions our joints and soft tissues.Without water as a routine part of our intake, we cannot digest or absorb

food. Some people have survived 8 to 10 days without water.

Maybe You Should Start Talking To Your Water

I recently watched this wonderful documentary that scientifically explains how water takes on the energy found in its surroundings. I have actually started talking to my water and infusing it with transforming energy. Scientist have taken samples of water and said words like "love" and "hate" and "Hitler". They then freeze the water and analyze the crystals.

The water that received positive affirmations has beautiful snowflake like crystals and the energy is heightened. The water exposed to the negative messages formed misshapes, ugly broken crystals and this happens every time.

Dr. Masaru Emoto's

Water

Experiment

Polluted water Yodo River, Japan Fujiwara Dam Water BEFORE prayer Fujiwara Dam Water AFTER Prayer

spring water Yusui Mountain Spring, Japan

thank you

you fool

heavy metal music

you make me sick

Beethoven's music Pastoral

love & appreciation

Water Crystals as photographed by Dr. Masaru Emoto



Words of love and encouragement are symetrical and pure like snowflakes



Words of hate, anger and criticism are discolored and malformed



Water Molecule, Before Offering a Prayer



Water Molecule, After Offering a Prayer



Thank You



You Make Me Sick, I Will Kill You



Love and Appreciation



polluted river compared to a clean stream

Water Crystal Photos from Tap Water in U.S. Cities



Los Angeles



New York



Denver



Dallas Area



The Rice Experiment

1. Place 1 cup of Cooked Rice into two separate containers. Place a lid on each.

2. Mark one container with a positive phrase. I used "Thank You Rice"

3. Mark the other container with a negative phrase. I used "Stupid Rice"

4. Place them in your kitchen at least 12 inches apart.

5. Once or more every day say aloud to the rice container the phrase written on it. I know this sounds nuts but just try it. For example, every time I went into my kitchen I would say "Thank You Rice" and "Stupid Rice" Try to say it from a place of gratitude (thank you) and a place of anger and frustration (stupid).







THANK OPERATORS YOU