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Techno-watch

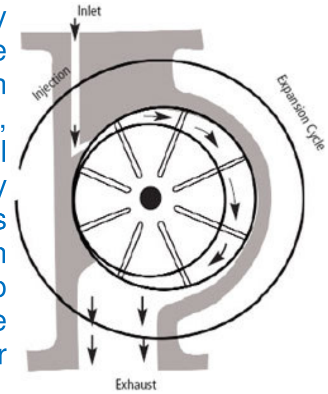
Smaller Watermelons

Watermelons are usually too large to be kept in the fridge. Lighter and smaller watermelons will hit the market soon. The recently launched ‘Freezer Watermelon’ developed by Camson Biotechnologies weighs no more than 3-4 kg unlike the conventional ones that weigh over 10 kg. Further, when cut, not a drop of juice goes waste or trickles from the melon.

The flesh is crunchy, soft and sweeter than the earlier varieties. Globally, Camson-type hybrid watermelon variety is known as ice box watermelon. Though hybrid seeds cost Rs. 45,000-60,000 kg, they were in demand as the yield was far higher than the conventional varieties.

The Camson’s two seed varieties- *Netravati* and *Vedavati*- are in demand in the tier-II and tier-III cities.

40 km for Rs 5



Students at SMS Institute of Technology in Lucknow are desperately waiting for mechanical engineering professor Bharat Raj Singh—to see his motorbike that runs on air. Fondly called *hawai* (airy) professor, Singh has built the engine and is working on the bike design with Onkar Singh, mechanical engineering professor at Harcourt Butler Technological Institute, Kanpur. The engine is a breakthrough in clean technology innovations; it uses the readily available air to generate energy and does not pollute. What is more, a motorbike powered with the air-engine can run at 70-80 km per hour and cover 40 km just for Rs 5. “Our effort was to create an engine as efficient as conventional bike but without the adverse effects of its internal combustion engine,” said Raj Singh. The professor duo has applied for a patent for the technology.

The engine has two components: an air tank and a turbine. Air is tightly filled in the tank using electricity or by pedalling. When required, the compressed air is passed through an inlet port to the turbine, where it impinges on the turbine vane and creates a rotational force, or torque. The rotational force is used to drive the bike, while the spent air is released to the atmosphere, explained the professors who did not wish to divulge the details.

But the compressed air can exert different rotational force depending on the angle at which it sets the vane in motion. To find the optimum force, the professor duo took the help of a mathematical model. The engine is at its best when the turbine has 10 vanes at an angle of 36° each and the compressed air is injected at an angle of 60° on the vane., they noted in the Journal of Renewable and Sustainable Energy.

“The air-engine is 70-90 per cent efficient,” said Raj Singh. Internal combustion engines used in fossil fuel-powered bikes are 18-20 per cent efficient. It may, however, take them another four to six months to develop a vehicle that could be put to commercial use. The challenge lies in the size of the air tank that are big to be fitted to bikes. The engine, in its present design for lab-testing, holds 20 bar of air pressure, sufficient to be used for 30-40 minutes or run 30 km. “We are trying to use a fibre tank that can sustain up to 300 bar air pressure so that the bike can run five to six hours or 200 to 250 km in a single fill,” Raj Singh said. This would be light and can be easily fitted to motorbikes.

The duo are optimistic about the technology, especially for two-wheelers. In India 77.8 per cent of vehicles are bikes. But is not developing an air-engine common in engineering colleges? In 2009, four students of Guru Nanak Dev Polytechnic College in Punjab developed an air-engine. It had three air tanks, weighing about 180 kg, and could give a maximum speed of 18 km per hour. “It could not give much speed because the air-tanks were made of steel and hence were heavy,” said Jagraj Singh Kaul, head of the automobile department in the college. The students wanted to replace them with carbon fibre tanks, but could not because of monetary constraints, Kaul added. A similar air-engine has also been developed by engineering students in Ferozepore.

Raj Singh clarified, “The students’ air-bikes are modified versions of the existing engine of conventional bikes. We have developed an engine that uses turbine and is based on a principle and mathematical calculations.”

Titanium foams replace injured bones

A new kind of implant, made of titanium foam, resembles the inside of a bone in terms of its structural configuration. Not only does this make it less stiff than conventional massive implants, it also promotes in growth into surroundings bones.

Among implants, the titanium alloy Ti6A14V is the material of choice. It is durable, stable, resilient and well tolerated by the body. But it is somewhat difficult to manufacturer: titanium reacts with oxygen, nitrogen and carbon at high temperatures, for example. This makes it brittle and breakable. The range of production process is equally limited.

There are still no established processes that can be used to produce complex internal structures. This is why massive titanium implants are primarily used for defects in load-bearing bones. Admittedly, many of these possess structured surfaces that provide bone cells with firm support. But the resulting bond remains delicate. Moreover, the traits of massive implants are different from those of the human skeleton: they are substantially stiffer and thus, carry higher loads.

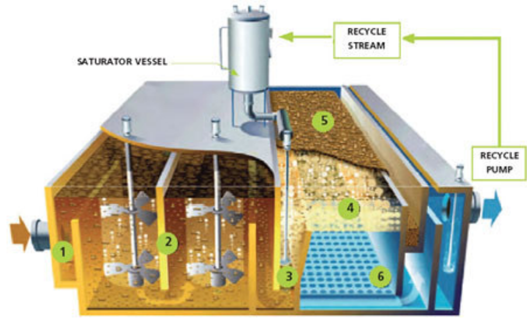
“The adjacent bone bears hardly any load anymore and even deteriorates in the worst case. Then the implant becomes loose and has to be replaced,” Dr. Peter Quadbeck of the Fraunhofer Institute for Manufacturing and Advanced Materials IFAM in Dresden, said. Quadbeck coordinates the “TiFoam” Project, which yielded a titanium-based substance for a new generation of implants. The foam-like structure of the substance resembles the spongiosa found inside the bone.

Powder metallurgy-based molding process

The titanium foam is the result of a powder metallurgy-based moulding process that has already proven its value in the industrial production of ceramic filters for aluminium casting. Open-cell polyurethane (PU) foams are saturated with a solution consisting of a binding medium and a fine titanium powder. The powder cleaves to the cellular structures of the foams. The PU and binding agents are then vaporized. What remains is a semblance of the foam structures, which is ultimately sintered. “The mechanical properties of titanium foams made this way closely approach those of the human bone,” reports Quadbeck.

“This applies foremost to the balance between extreme durability and minimal rigidity.” The former is an important precondition for its use on bones, which have to sustain the forces of both weight and motion. Bone-like rigidity allows for stress forces to be transmitted; it also fosters healing of the implant. Consequently, stress can and should be applied to the implant immediately after insertion.

Floating bubbles catch dirt



Bengaluru residents look forward to December 2011, when the new water treatment plant at T K Halli would deliver 500 million litres of potable water every day. This would increase each person's daily water allowance in the city by 25 litres. Bengaluru Water Supply and Sewerage Board (BWSSB) fast-tracked the plant by 12 months; this was possible because of Dissolved Air Flotation (DAF) system, patent of French company Degremont, the water and waste water technologies leader that will build and operate this facility.

A first of its kind installation in India, DAF is used for the primary stage removal of suspended particles in water; it is distinctly different from conventional methods of reducing turbidity. Conventional methods involve chemical coagulation to group particles into flocs. These flocs, or particles of greater density, are given time to settle down and then removed. In a DAF system, tiny air bubbles are injected to the water; particles adhere to the bubbles and float to the surface, forming a layer of froth that is removed intermittently (See schematic and explanation). Chemicals are needed in the DAF system only when the water is highly turbid. But since that is not the case in Bengaluru, DAF is particularly suited here.

The conventional method, in fact, is not able to take advantage of the low turbidity in the area's water because coagulants are necessary for flocculation of suspended particles. The five-year data shows that turbidity in the raw water remains well under 10 nephelometric turbidity units (NTU) for seven to eight months in a year. This will make it possible for the plant to run in what is called direct filtration mode, where water is taken directly to the flotation tank, bypassing the clarifiers thereby reducing chemical and electrical consumption. This will also reduce costs.

"During monsoon water turbidity is likely to go up to around 100 NTU," said R Vasudevan, chief engineer, BWSSB. Typically, turbidity of up to 100-150 NTU can be handled by increasing the chemical dose, mainly polyelectrolyte that acts as an efficient binder. The clarification rate of Degremont's DAF unit (40,000 litres per square metre per hour) is more than 10 times that of conventional methods. Thus large quantities of water can be cleaned with smaller sedimentation tanks. This saves space— the area footprint of AquaDAF is four to five times smaller.

David Johnstone, international public health consultant affiliated to Oxford University in the UK said, "DAF is a three-decade-old established process for potable water and can save a large area as compared to settlement tanks." The construction site for the T K Halli waterworks is undulating and located upon rocky strata; it is, therefore, more suited to DAF. A small footprint technology such as DAF would require less civil works and therefore lower the cost.

"AquaDAF is now acceptable to Indian clients for implementation in large capacity projects. This was not the case when the first phase of T K Halli water treatment plant

was conceived over 10 years ago," said Vipul Goyal, general manager of Degremont's technical division. This also demonstrates Indian municipal clients are opening up to contemporary water treatment technologies, he added.

Since DAF clarifies the water by removing the floating froth as opposed to settled sludge, the technology also tackles the problem of algae. Low to moderately turbid water has extremely low density particles and has a tendency to support algal blooms. "Algae can choke filters in the next stage of treatment," said Goyal. This is tricky and is not effectively dealt with by conventional settling systems, he added. BWSSB has signed a Rs 236-crore, seven-year contract with Degremont.

1. **Coagulant (alum or ferric chloride) is added at raw water inlet**
2. **After 8-10 minutes particles join to form flocs**
3. **8-12 per cent of water passes through a pressurised saturator vessel**
4. **The saturated air-water recycle stream introduces micro bubbles**
5. **Solids attach to the bubbles and accumulate on the surface as sludge**
6. **Sludge is removed and clarified water is collected uniformly across a perforated floor.**

Source: Processed Food Industry, www.downtoearth.org.in and Chemical Weekly

Note: The author may have used various references in the preparation of this article. For further details please contact him/her.