Artificial Nose

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The human nose is very powerful. It can detect up to 10, 000 different smells. An odor is inhaled through the nostrils and the odor molecules then cause cilia attached to nerve cells in the olfactory epithelium on the roof of the nasal cavity to vibrate. Attached to the cilia are millions of special receptors that are sensitive to odor molecules. The vibrations caused by the odor molecules produce nerve signals that move along the receptors and travel to the olfactory nerve which transmits the signals to the olfactory bulb. The brain then interprets the signal and identifies the smell.

The sense of smell allows humans to do many things. We can differentiate between smells that are pleasant and smells that are unpleasant. We sense when we are in danger if we can smell a scent that is associated with something that can cause harm.

An artificial nose would be able to monitor manufacturing processes to make sure the correct substances were being used, track pollutions, sniff out contraband drugs and explosives, and many other applications.

There are currently three different types of artificial noses that are being tested. One uses colors to 'fingerprint' different scents, one uses sound to differentiate between scents, and one uses sensors similar to the ones found in the human nose to detect smells.

The 'Seeing' nose uses a process similar to the use of litmus paper to test solutions. Tiny dots of different dye called metalloporphyrins are painted on an inert backing such as paper, plastic, or glass. The chemicals in the odor cause the dye to change color, and each individual odor tested creates a different array of colors. New scents can be compared to these 'fingerprints' and determined. This process can detect smells 10 to 100 times better than the human nose and is not affected by humidity. It cannot however, detect the amount of a substance present.

The 'hearing' nose consists of a long tube with a quartz crystal and a signal sensor. The odor is introduced into the tube and the chemical constituents separate as they travel down the tube and alter the vibration of the crystal. The time required for each constituent to reach the sensor and the amount it effects the crystal's vibration is measured and the identity of the substance and the quantity in which it is present can be calculated by the software incorporated in the instrument. The entire process takes only 10 seconds but it is affected by humidity.

The Biographical nose consists of a gas chamber with an array of gas sensors that mimic the receptors in the human nose. Odor flows into the chamber and the sensors before linear discriminate analysis and create a 2D scatter map. The placement of different odors on the graph is what differentiates the odors. This system is also effected by humidity but differentiates between different scents very effectively.

In the future Artificial Noses will be used to detect pollution, to help fight terrorism by detecting explosives, biological and chemical weapons, and over the internet. They are also researching ways to integrate the 'hearing' nose with global positioning satellites to be able to detect chemical weapons in any part of the world.