Chemical Engineering Processes via Art

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Chemical Engineering deals with industrial processes in which raw materials and the work of chemists and physicists are transformed into commercial realities. We are usually acquainted with the sciences on which such processes are based, but don’t pay attention to how art can serve in demonstrating these processes. This will be done by various paintings on the back page, noting that in many cases the artist had no intention at all of demonstrating any scientific or engineering concept in his painting; nevertheless, they are there.

The history of processes starts with the creation by God, 5700 years ago, of our universe, which included the sky and earth, man and woman and all the rest. However, Radiation processes began when God said: “Let there be lights...” (Genesis 1:14) (Figure 1). These processes are demonstrated here by Vincent van Gogh’s (1853-1890), Dutch, one of the greatest Expressionists in modern art, in his painting “Pollard Willows and Setting Sun” (1888).

Rene Magritte (1898-1967), Belgian, one of the most important Surrealist artists and perhaps the most widely popular modernist painter of the 20th century, “contributes" two paintings to our subject. His “Heraclitus’s Bridge” (1935) is a powerful demonstration of a Sublimation process by which solids are transformed directly to the vapor state without passing through the liquid state (Figure 2). Here half of the bridge seems to have been sublimed, although what happened is that a patch of dense white cloud, which cover half of the bridge creates this illusionist process. Magritte’s other painting, “The Philosophical Lamp” (1936), illuminates two absurd sights, the first a closed circle of smoke with mouth, pipe and nose constituting a single entity. The second is formed by the candle, the wax of which, while soft and already melted at its lower end, is increasingly firm towards the burning wick, towards the light. With respect to engineering processes, it may demonstrate a cyclic process in which a fluid undergoes several steps while flowing around the loop, where, eventually, it returns it its initial state. Power cycles, are very common examples and the most famous one is the Carnot cycle (Figure 3).

Combustion processes or burning are very ancient phenomena and, as a matter of fact, associated with the progress of mankind. The first process, according to Genesis 19:24, took place in Sodom and Gomorrah: “Then the Lord rained down burning sulfur on Sodom and Gomorrah...” (Figure 4).
from the Lord out of the heavens.” It was only in 1783 that the great French chemist Antoine Lavoisier investigated the properties of oxygen and laid the foundation for modern chemistry and combustion. Jacek Yerka (1952), Polish, describes in a brilliant way a Combustion process in his painting “Eruption” (1990) which shows light streams flicking on and off, up and down, illuminating the houses on the mountains slopes (Figure 4).

Compression processes have many “faces”: the process of squeezing more data in a smaller storage; to limit dynamic range in music, that is, for example, to make loud parts quieter, where in Chemical Engineering it is self-evident (Figure 5). Cesar Baldaccini (1921), born in Marseilles, in his status “Compression” (1970) demonstrates what happens when the components of a bicycle have been squashed into a square block.

Extraction processes may be demonstrated by Mark Rothko’s (1903-1970) painting “White and Greens in Blue” (1957) (Figure 6). He was a Russian-born U.S.A painter, one of the leading figures of Abstract Expressionism whose work consisted of large-format paintings of blurred colored rectangles. In the above painting, two stages in the Extraction process may be observed. In the upper part of the picture, above the white line in the middle, the two phases are completely mixed, corresponding to one color in the painting. In this region mass transfer takes place, namely, the mixing and Extraction stage (Figure 7). In the lower part of the picture, the phase separation stage is demonstrated by the two layers of the immiscible liquids having different colors (Figure 6).

Diffusion, Crystallization, Evaporation and Condensation processes are only part of striking color photographs by Walter Wick which appear in his astounding book [1] (Figures 8 and 9). In his Diffusion, a drop of blue water enters a jar of clean water, while two states out of nine are shown demonstrating the progress of the Diffusion process (Figure 8). Crystallization is demonstrated by ice crystals which grew into an astonishing six-sided design (Figure 10). His Condensation photograph may be looked upon also as an Extraction process in the
following way. The drops are created due to mixing of the two phases above and below the drops while mass transfer takes place in the region of the drops.

*Pumping processes* are demonstrated by Leonardo da Vinci’s (1452-1519) drawing “Archimedes Screw and Pumps to Draw up Water” (c. 1480) and *Mixing processes* by Diego Rivera (1886-1957), Mexican painter of social themes who painted on murals for public buildings, in his work of art “The Sugar Mill” (1923) (Figure 11).

And finally, *Impinging-stream processes* [2] (Figure 12). Here, a unique configuration of a two-phase suspension, gas-solid, is applied for intensifying transfer processes. In this method, two streams of the suspension flowing on the same axis in opposite direction are colliding. If each stream contains particles of a different color, then, while colliding, particles from one stream penetrate into the opposite one; eventually effective mixing will occur yielding as a product a homogeneous mixture of particles. “Encounter” (1944) by Maurits Cornelis Escher (1898-1972), a Dutch, the greatest graphic artist, illustrates such a process. According to Escher, a white optimist and a black pessimist meet each other shaking hands while walking in opposite directions one towards the other. Eventually at the back, after good mixing takes place, a “homogeneous solution” is obtained.

So, in conclusion, don’t Chemical Engineering Processes look nicer via Art?

**References**