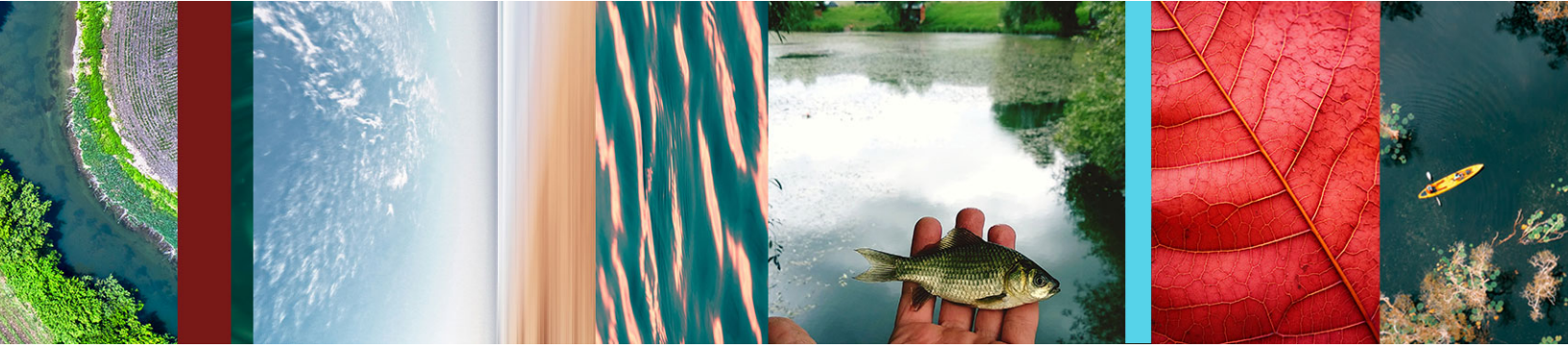

Biodegradability by Respirometry

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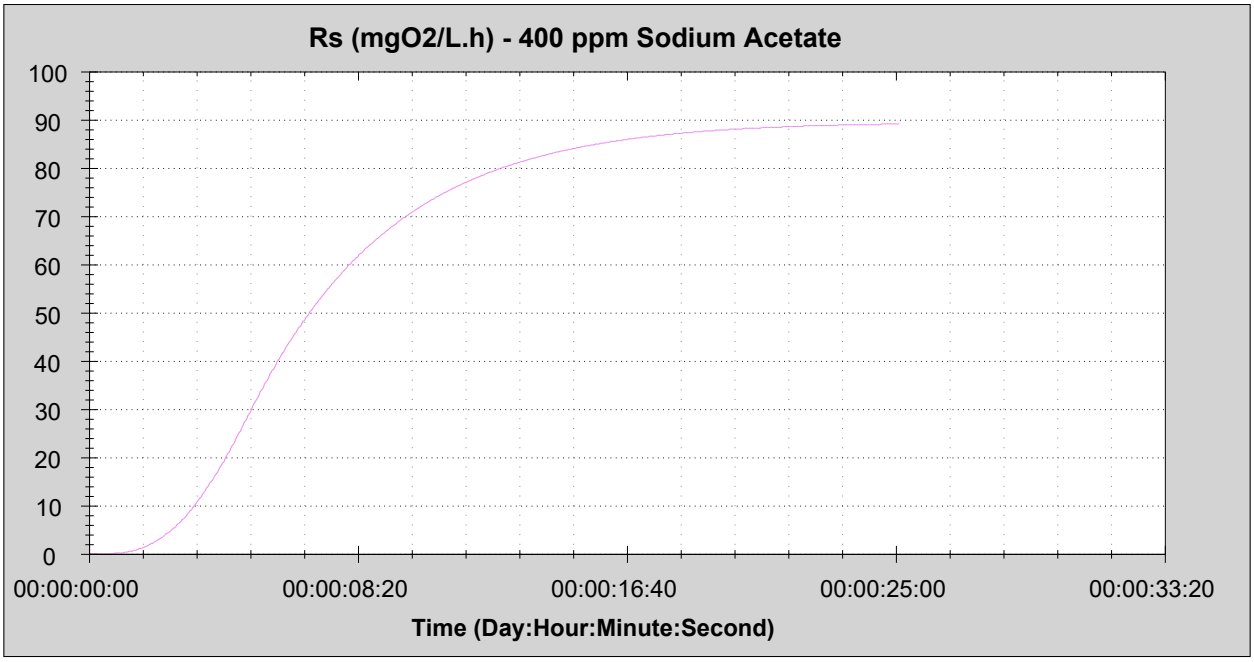
Contents

Biodegradability by Respirometry

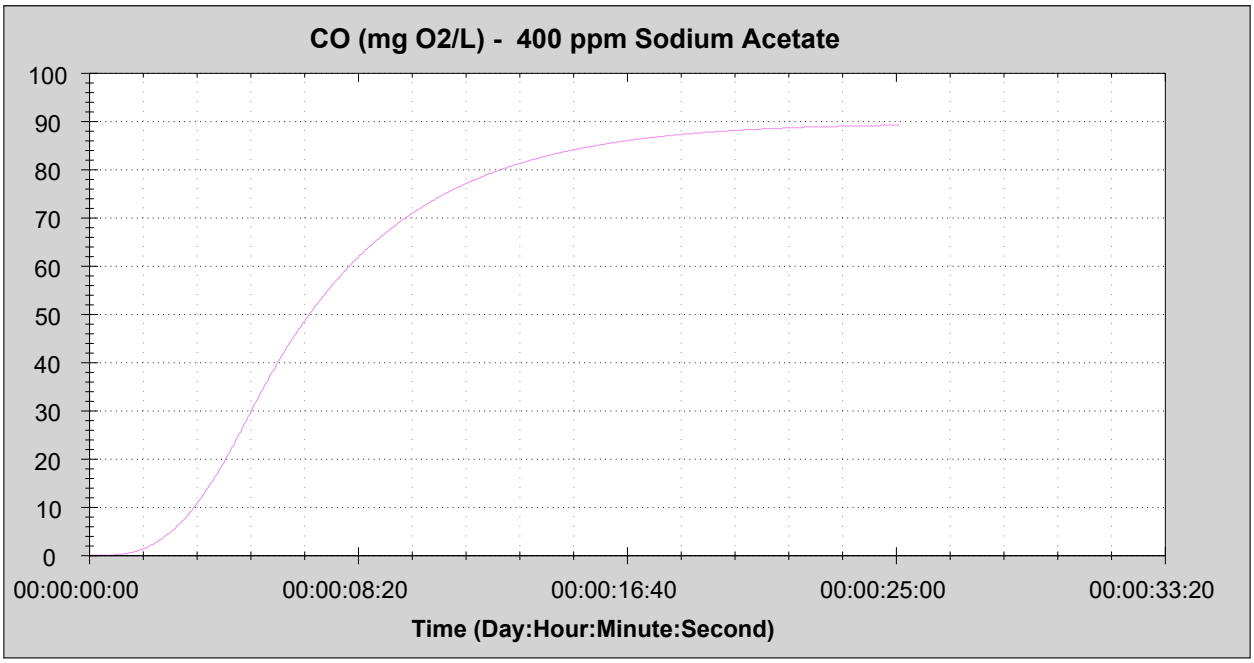
Samples of two products (Product 1 and Product 2) were submitted to determine biodegradability by specific activated sludge process. The sludge collected on 11/05/23 was aerated overnight to reach the endogenous respiration state and was used in consecutive experiments.

Determination of heterotrophic yield coefficient (Y_{COD}) of the activated sludge process

The heterotrophic yield coefficient Y_{COD} of the sludge was determined using 400 ppm sodium acetate standard (Pictures 1 and 2).



Picture 1. Dynamic Respiration Rate (Rs) of the sludge with Sodium Acetate standard



Picture 2. Consumed Oxygen

$Y_{COD} = 1 - CO / COD_{acetate} = 1 - (89.1 / 300) = 0.70$

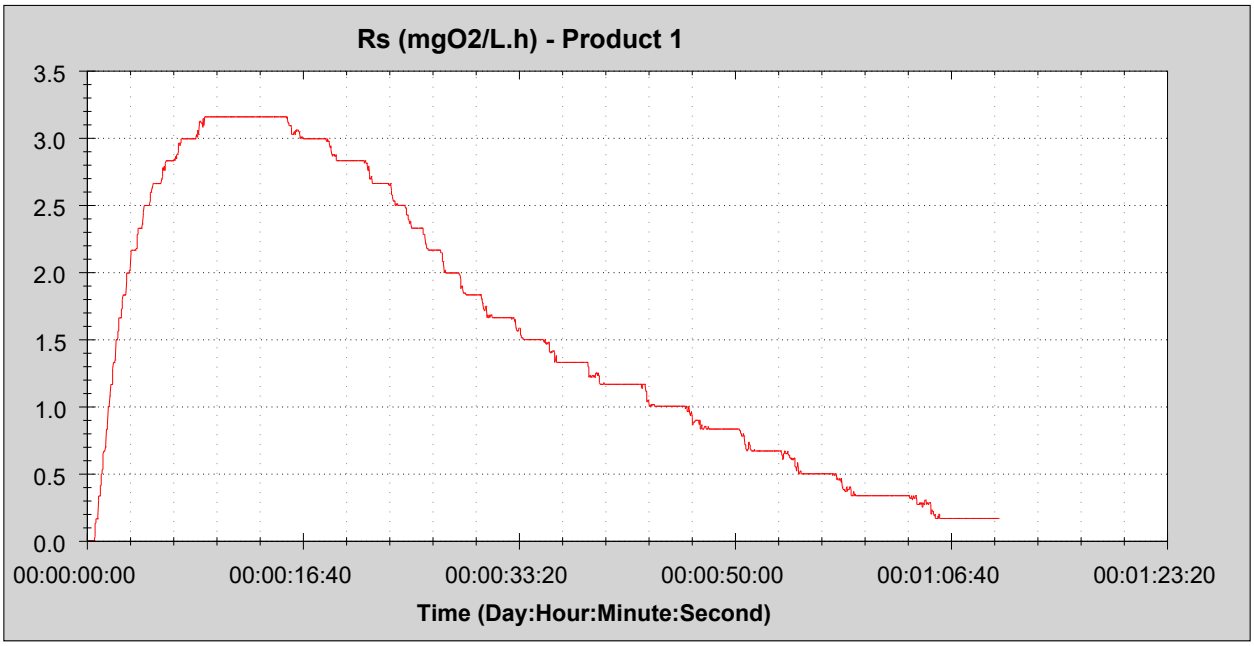
The Y_{COD} was used in consecutive tests to determine biodegradability of products.

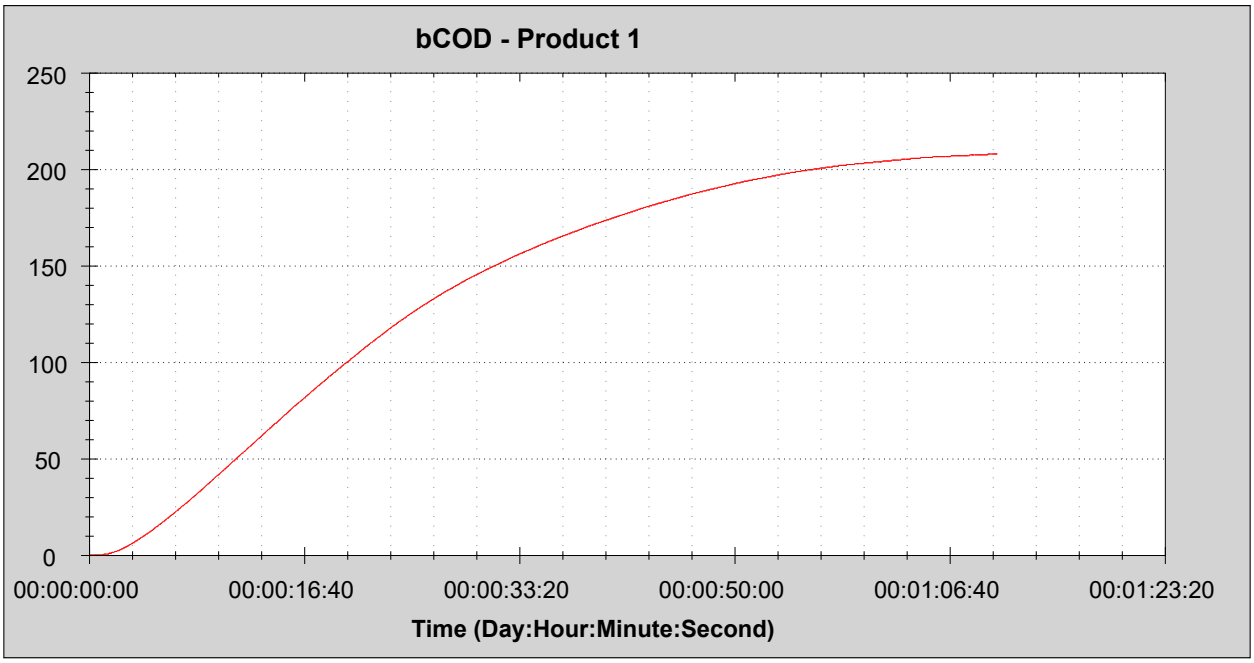
To determine biodegradability, dilutions of both products were prepared and total COD of solutions was determined by EPA method 410.4. The following table summarizes the data.

Product	Prepared Concentration	COD mg/L
Product 1	1060 ppm	637
Product 2	1150 ppm	1701

Biodegradable COD (bCOD) – Product 1

Biodegradable COD (bCOD) was determined by means of the R test with dilution of the product added to the biological reactor containing sludge that reached endogenous respiration. BM-respirometer software automatically calculates the on-going bCOD value by making use of the Y coefficient and the accumulated consumed oxygen (CO).





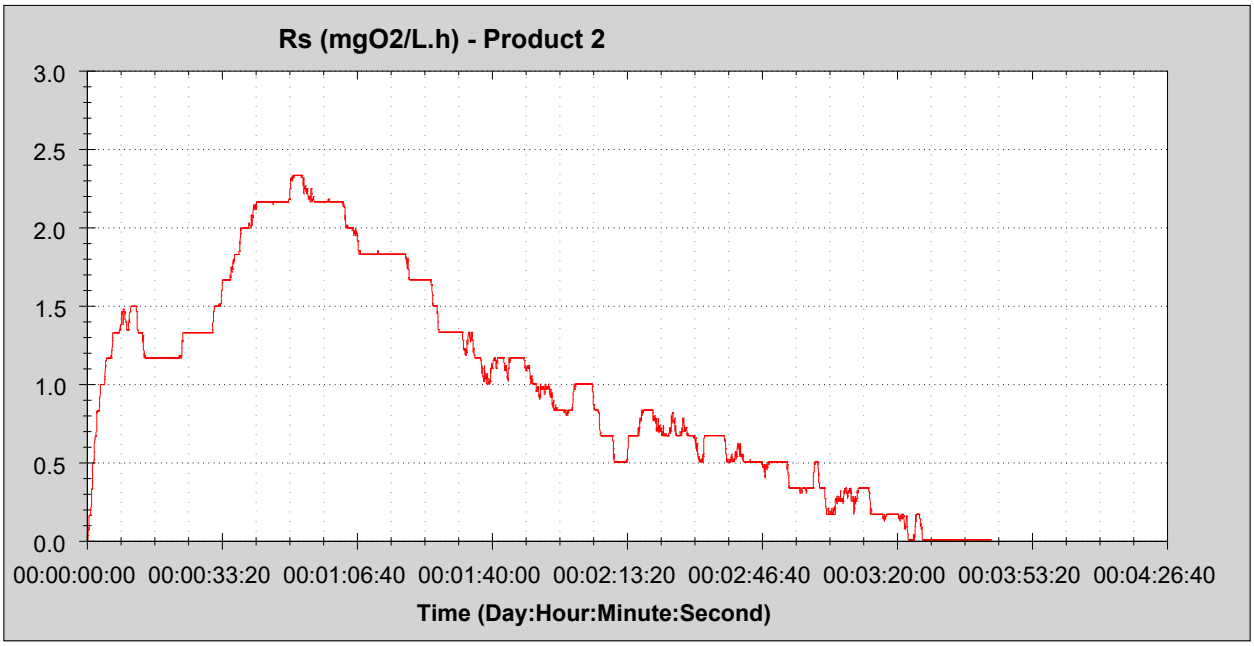
Biodegradable COD (bCOD) = 208 mg/L

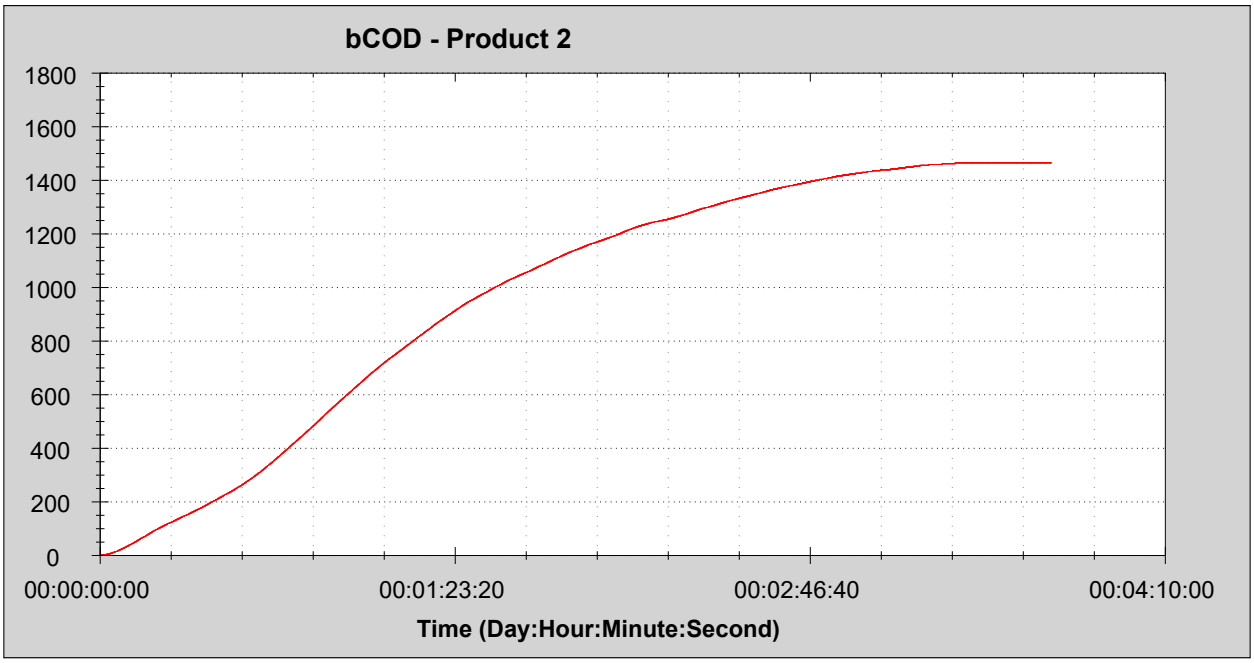
Biodegradability = 100 * bCOD / COD = 100 * 208 / 637 = 33%

Non-Biodegradable COD (nbCOD) = 100 – 33 = 67%

Biodegradable COD (bCOD) – Product 2

Biodegradable COD (bCOD) was determined by means of the R test with dilution of the product added to the biological reactor containing sludge that reached endogenous respiration. BM-respirometer software automatically calculates the on-going bCOD value by making use of the Y coefficient and the accumulated consumed oxygen (CO).





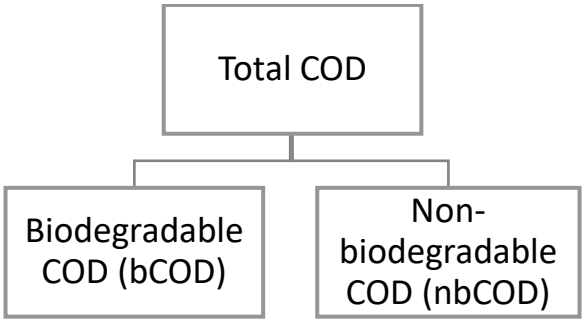
bCOD = 1470 mg/L

Biodegradability = 100 * bCOD / COD = 100 * 1470 / 1701 = 86%

Non-Biodegradable COD (nbCOD) = 100 – 86 = 14%

Biodegradability for a specific activated sludge process

This biodegradability obtained from the activated sludge in respirometry experiments, under equivalent conditions to the actual ASP, should be considered not only from the biodegradable character of the wastewater sample to be analyzed but also from the sludge activity health and sample adaptation to the biomass. For that reason, this type of biodegradability is specific for the activated sludge responsible of the organic matter oxidation of the wastewater.



The table below can be used to assess biodegradability of analyzed products.

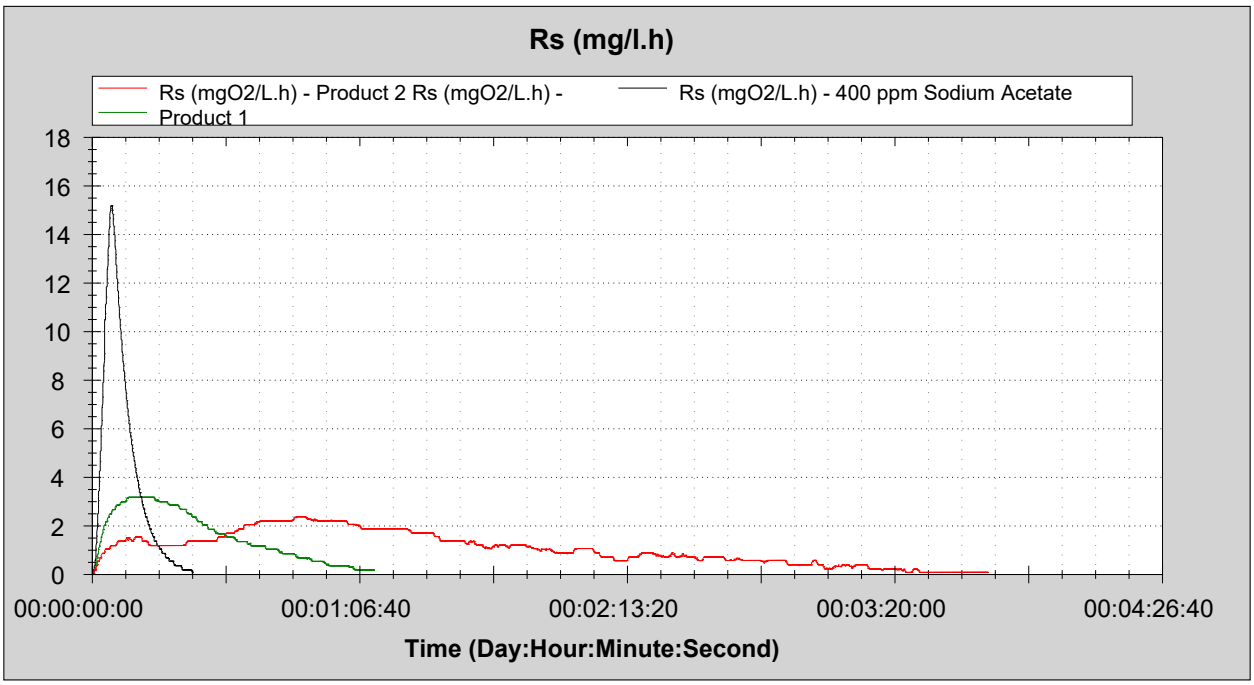
Ratio bCOD / COD	**Character**
> 0.8	Very biodegradable
0.7 – 0.8	Biodegradable
0.3 – 0.7	Very little biodegradable
< 0.3	Un-biodegradable

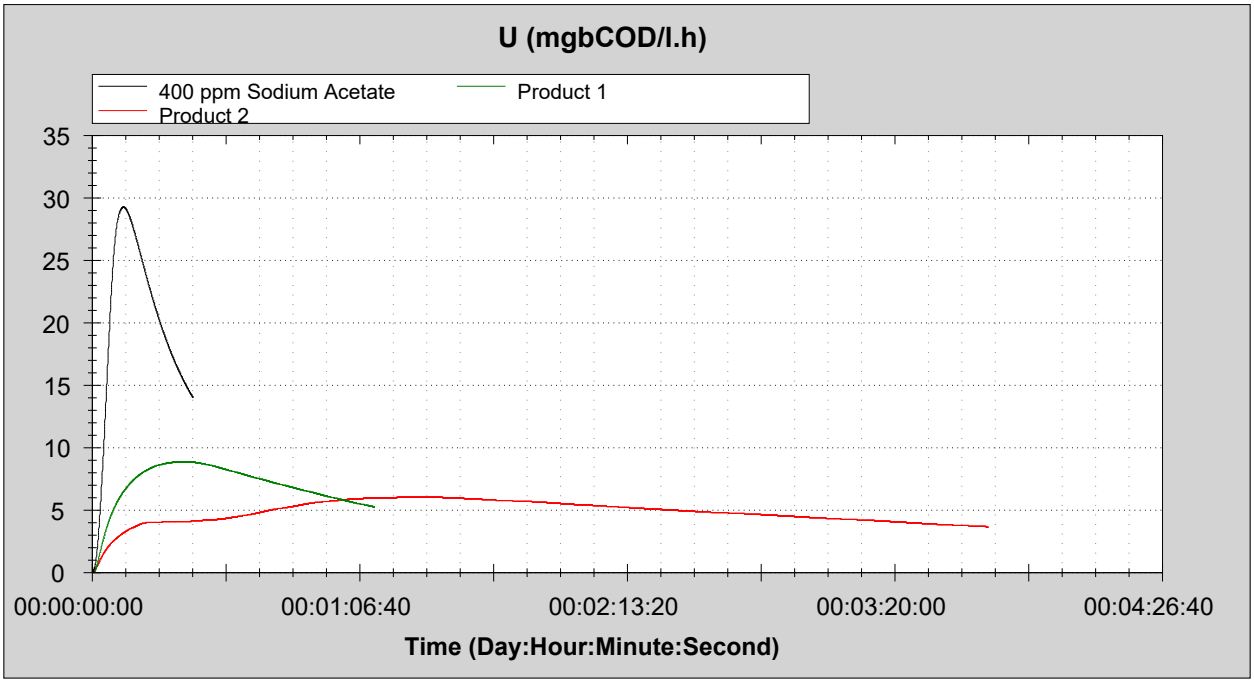
Product	Prepared Concentration	COD mg/L	bCOD mg/L	Biodegradability %	Assessment
Product 1	1060 ppm	637	208	33	Very little biodegradable
Product 2	1150 ppm	1701	1470	86	Very biodegradable

bCOD elimination rate (U)

In addition to determination of biodegradable COD, respirometry allows to establish a Substrate Uptake Rate (U) for each product and to calculate required Hydraulic Retention Time required to biodegrade products.

Both products exhibit lower Substrate Uptake Rate (U) compared with the readily biodegradable sample of sodium acetate.





Required HRT to eliminate bCOD for Product 1

U last (mgbCOD/l.h) = 5.17

HRT = 2.66 d = 63.84 h

Product 1 concentration in the wastewater: 3.7 ppm

bCOD to be eliminated = 3.7 * 0.196 = 0.73 mg/L

Time necessary to eliminate the bCOD = 0.73 / 5.17 = 0.14 h

63.84 h > 0.14 h – There is enough HRT in the process to eliminate the bCOD from the Product 1

Required HRT to eliminate bCOD for Product 2

U last (mgbCOD/l.h) = 6.47

HRT = 2.66 d = 63.84 h

Product 2 concentration in the wastewater: 10.3 ppm

bCOD to be eliminated = 10.3 * 0.739 = 7.6 mg/L

Time necessary to eliminate the bCOD = 7.6 / 6.47 = 1.17 h

63.84 h > 1.17 h – There is enough HRT in the process to eliminate the bCOD from the Product 2