CO-GENERATION OF BIOCHAR & RENEWABLE ENERGY FROM CENTRAL VALLEY AGRICULTURAL BYPRODUCTS

ABSTRACT

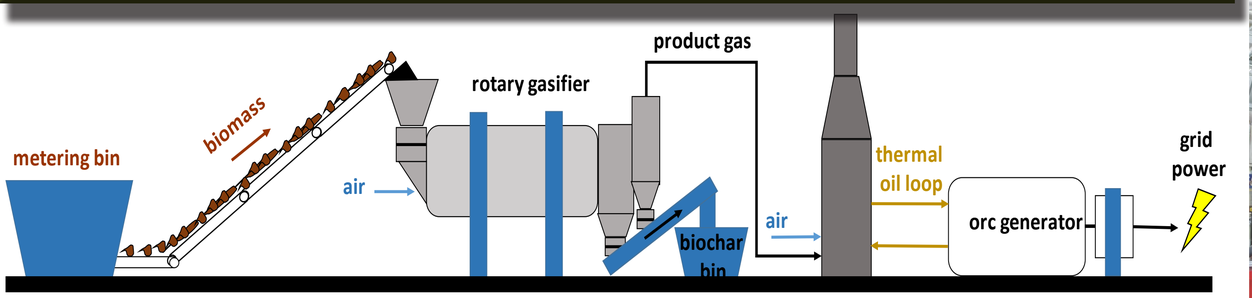
The Central Valley in California is one of the world's most productive agricultural regions consisting of many high value specialty crops with revenues of more than $46 billion in 2016-2017 . The byproducts from the production of these crops (e.g. hulls, shells, prunings, vines, orchard removals, etc.) pose a persistent waste disposal problem and cost to the industry and environment. However, these biomass byproducts could be converted into a resource as steady feedstocks for biochar and renewable energy production. West Biofuels is using a rotary drum type gasifier system, which processes the material at a moderate temperature (500~750F) to convert it into a high-quality active biochar and energetic syngas. The process is adapted for the unique types of feedstocks (nut shells and hulls, tree prunings, rice hulls, grape seeds and stems, livestock manures etc.) and desired properties of the biochar (carbon content, active surface area, inorganics content, etc). The biochar can be utilized for beneficial soil enhancer in agricultural and horticultural applications or for filtration and construction industries. The syngas from this process is used to drive an Organic Rankine Cycle turbine generator system to produce renewable electrical power for the grid. The combination of biochar and energy production is a viable and beneficial option for California agriculture.

i. https://en.wikipedia.org/wiki/Central_Valley_(California)

ii. California Agricultural Statistics Review, 2016-2017 https://www.nass.usda.gov/Statistics_by_State/California/Publications/Annual_Statistical_Reviews/2017/2016cas-all.pdf

WestBiofuels

PROCESS DIAGRAM



ORC TURBINE GENERATOR

ROTARY GASIFIER TEST UNIT

1.5 MW ROTARY GASIFIER

BIOCHAR PROPERTIES

Properties/feedstocks	Forest Wood	Almond Shells	Rice Hulls
Mass Loss (% db)	87.52	66.27	50.37
Volatile Loss (% db)	96.00	86.90	87.36
Bulk Density (lb/ft3)	8.1	6.1	8.7
Organic Carbon (% db)	70.6	64.6	44
Total Ash (% db)	11.9	12.5	46.1
Total Nitrogen (% db)	0.56	1.83	0.6
pH value	6.3	9.8	10.03
Electrical Conductivity EC 20 w/w (dS/m)	0.101	2.03	0.337
Liming neut., Value as-CaCO3 (%CaCO3)	5.6	15.3	5.6
Carbonates, as CaCO3 (% CaCO3)	0.9	3.5	0.2
Butane Activity (g/100g dry)	3.9	0.6	1.8
Surface Area Correlation (m2/g dry)	258	152	191
Chlorine (ppm)	ND	485	767
Sodium (ppm)	ND	1260	ND
Iron (ppm)	4320	1033	233
Total (K) (mg/kg)	4427	59268	10066
Total (P) (mg/kg)	443	2213	1008
Organic (Org-N) (mg/kg)	5625	18274	5995

Cotton Gin Trash

Forest Wood

Rice Hulls

Walnut Shells

Wood Sticks

Almond Shells