Carbon Char

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Carbon Char is the residual solid that remains after processing organic material using EPi's unique technology. This residual solid is a high quality, energy rich, carbon char representing around 18% by weight of the original material, when processing pure biomass, achieving an overall reduction by weight of around 82%. For material streams derived from mixed waste a reduction of 20% - 23% by weight would be a more realistic expectation, due to the presence of inert material (metal, mineral and glass) which passes through our process unchanged.

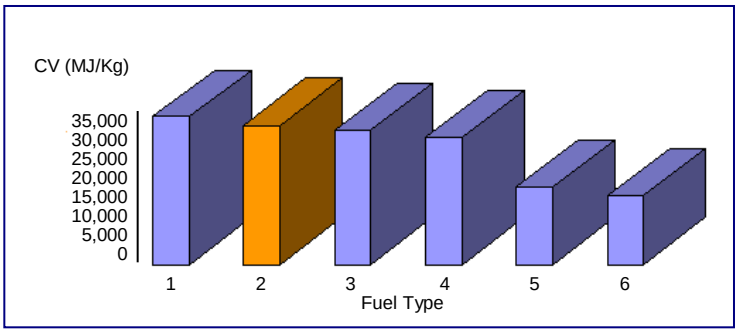
The volume of the char might initially vary, due to changes in both density and composition of the different types of material being processed, however, final stages of recovery tend to compress the char, reducing particle size to give a final reduction in volume of 90% or more, when compared against the volume of the original feed material. Reducing the char to a powder presents the opportunity for secondary removal of any remaining metals that might have been carried over from the original incoming feed stock..

Any variation in the composition of the char will be a direct consequence of the non-organic components within the incoming feed material. This is because the organic content will always be reduced to carbon. However, the inert content within the original waste stream will remain unchanged, thereby affecting the percentage of carbon within the remaining char and thus the overall calorific value.

The char offers a number of commercial possibilities, but even in its most basic form provides the opportunity for substantial energy generation. The char is very pure. Volatile matter (SVOC's & VOC's) that may have been present within the original feed material are destroyed during the process, leaving a product that is inherently cleaner than its naturally occurring alternatives, e.g. bituminous coal.
How the char compares to some of the more traditional, established sources of fuel is demonstrated in the tables and graph shown below :

Typical Calorific Values (Cv) of Carbon Based Fuels :

FUEL TYPE	CV. (MJ / kg)
1. Anthracite	32,500 - 34,000
2. EPi Carbon Char	**30,700 From Biomass**
3. Charcoal	29,600
4. Coke	28,000 - 31,000
5. Bituminous Coal	17,000 - 23,250
6. Coal	15,000 - 27,000



EPi's char from pure biomass compares favourably with the very best of the carbon based fuels in terms of heat and energy output. Furthermore, the added bonus of being classified as smokeless, offers substantial environmental benefits over more traditional, coal based fuels. The CV value of the char from mixed waste is more reliant upon the composition of the original material and the original inert content
The following table provides typical compositional data for the carbon char as produced from a pure biomass stream. The second table provides a detailed analysis of the 9.1% residual ash left behind, after combustion of the carbon char. The percentages shown in brackets are expressed as percentages of the whole. The collective balance being made up of remaining compounds that are too small to measure.

Analysis of Carbon Char (from Biomass)

	% Air dried basis	% Dry basis
Moisture	1.07	~
Ash	9.1	9.2
Volatile Matter	12.4	12.5
Sulphur	0.18	0.18
Chlorine	0.01	0.01

The above analysis shows that both the char and ash residues are exceptionally good. As a comparison raw wood contains almost 80% volatile material, with bituminous coal falling somewhere between 30 - 40%. Sulphur at 0.18 is regarded as little more than a trace, whilst Chlorine is considered at the limit of detection. The char is far cleaner than many naturally occurring alternative fuels and poses no environmental hazard either before or after combustion.

Elemental Char - Ash Analysis (9.1 % of Whole)

Elemental Oxides	% m/m as analysed
Silica SiO_2	31.1 (2.83 %)
Alumina Al_2O_3	16.1 (1.46 %)
Iron Fe_2O_3	3.9 (0.35 %)
Titanium TiO_2	0.7 (0.06 %)
Calcium CaO	5.4 (0.49 %)
Magnesium MgO	2.1 (0.19 %)
Sodium Na_2O	1.3 (0.12 %)
Potassium K_2O	12.0 (1.09 %)
Manganese Mn_3O_4	0.1 (0.01%)
Phosphorus P_2O_5	8.1 (0.74 %)
Sulphur SO_3	9.0 (0.82%)

Based upon the above, one tonne of pure biomass will produce around 180kg of high cv carbon char. A plant processing 40,000 tonnes per annum will produce approximately 7,200 tonnes of char per annum. In real terms this gives the equivalent annual heat and energy output of over 9,500 tonnes of the best quality bituminous coal.

Whilst it is abundantly clear that there is substantial value in the carbon char when used as a fuel, certain cellulosic material streams (i.e. wood or plant based), offer opportunities for enhanced value applications in the form of activated carbons, which are used extensively in the air and water purification industries.

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