Evaluations of River-eco charcoal on the blood routine and blood biochemical values in rats

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Introduction

In the past 20 years, the amount of everyday life rubbish has increased very fast as the world population increased and urbanized. The treatment of everyday life rubbish has become one of the biggest world problems. The idea that rubbish is not "rubbish", it's a misplaced resources, and it should not be a burden to the nature and should be recycled, returning to the nature in harmless forms, is being recognized by more and more governments and people.

For this purpose, in Kawasaki Iron and Steel Co. Ltd, Japan, the rubbish from family life is being treated by so called charcoalization process, through which the rubbish undergoes drying, breaking, and shaping to become refuse derived fuel (RDF). This RDF, about half of the original rubbish volume, contains 3.5% of water and 4,000~5,000 kcal/kg of energy and can be used as fuel for generating electric power and boiler. Apart from stable combustion, its shape is also suitable for transportation and preservation. Furthermore from this RDF charcoalization system, not only produced high quality of carbon material called "River-eco charcoal", but also all components of the PDF were known through solution test and components analysis test, such as various organic mercury, cadmium, lead, organic phosphorus, 6-chrom, arsenic, cyanogen, PCB, trichloroethylene, tetrachloroethylen, dichloromethane, carbon tetrachloride and so on. In order to evaluate the safety of River-eco charcoal for animals and human being, we designed this experiment. Here we report the results of effects of River-eco charcoal on the blood routine and blood biochemical values in rats.

Material and Methods

Thirty SD strain rats purchased from Clea Co. Ltd were used in this experiment. Among them 15 rats were used as control group to feed them normal MF pellet food (purchased from Orient Yeast industrial Co. Ltd), and remaining 15 rats were used as test group to feed them MF powder food which contained 20% of River-eco charcoal for 3 months. Before and after experiment the blood samples were taken and tested for the following items: blood generally test for WBC, RBC, Hb, Ht, MCV, MCH, MCHC, platelet, CPR fixed quantity, CPR quantitative analysis; blood biochemical test for total bilirubin, direct bilirubin, indirect bilirubin, GOT, GPT, Ch-E, ALP, γ-GTP, CPK, serum amirase, total protein, albumin, A/G rate, TTT, ZTT, total cholesterol, neutral fat, HDL-C, TCH/HDL, LDL-c, urea nitrogen, uric acid, creatinine, serum iron, NaCl, Na, Cl, K, Ca, inorganic phosphorus and blood glucose etc. The data were processed statistically.

Results

For blood routine tests, although the numbers of red blood cells and white blood cells, and the values of hemoglobin and hematocrit, CPR fixed quantity, CPR quantitative analysis were lower after fed with 20% eco charcoal food in test group, there was no significant differences (see Fig, 1 and 2). While the numbers of platelets were higher, there were no differences in the values of MCV, MCH, MCHC (see Fig.2).

On the other hand, for blood biochemical tests, although the values of total bilirubin, direct bilirubin, ALP, LAP, CPK, serum amirase, total protein, albumin, TTT, ZTT, total cholesterol, neutral fat, HDL-c, LDL-c, urea nitrogen, uric acid, serum K and Ca, blood glucose had a little increasing tendency, there were no significant differences comparing with the values of before feeding eco-charcoal.

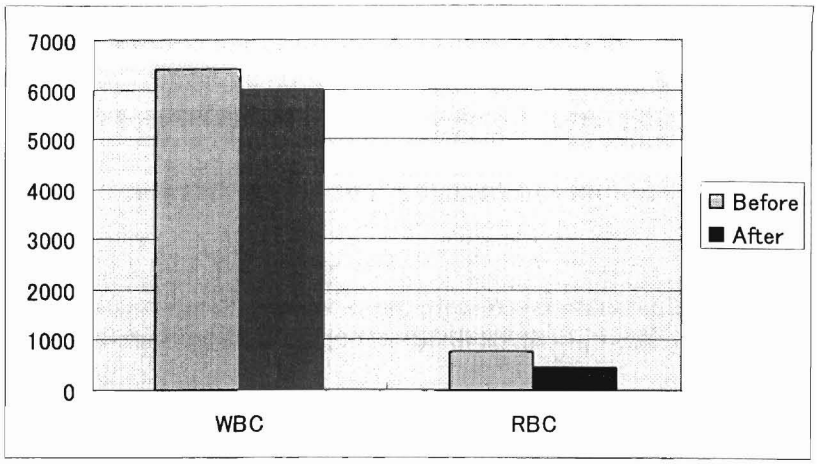

Fig.1 Influence of WBC and RBC by supply MF add "ECO CHARCOAL" food in Rats

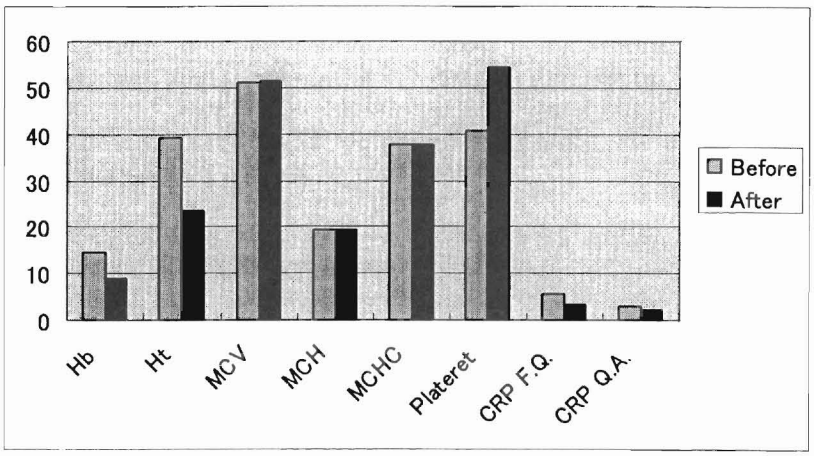

Fig.2 Influence of Hb, Ht, MCV, MCH, MCHC, Platelet, CPRF.Q. and CPRQ.A. supply MF add "ECO CHARCOAL" food in Rats

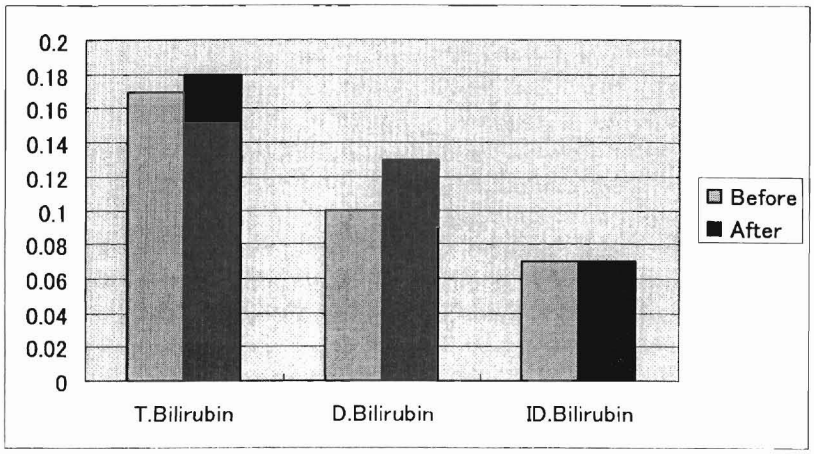

Fig.3 Influence of T. Bilirubin, D.Bilirubin and ID.Bilirubin supply MF add "ECO CHARCOAL" food in Rats

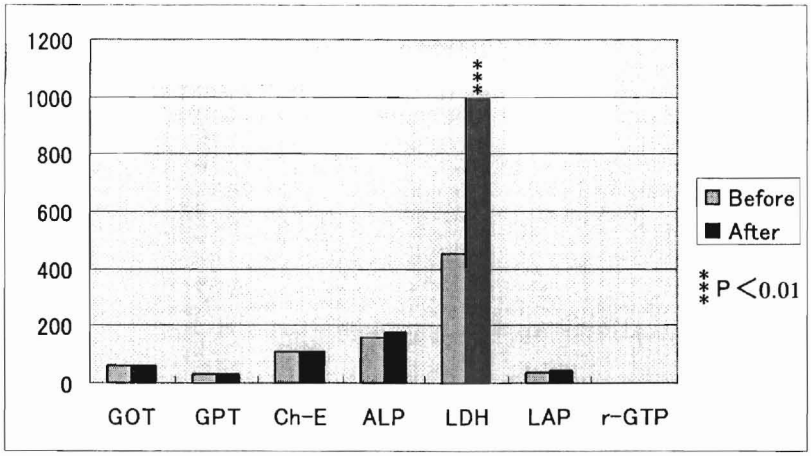

Fig.4 Influence of GOT, GPT, Ch-E, ALP, LDH, LAP and γ-GTP supply MF add "ECO CHARCOAL" food in Rats

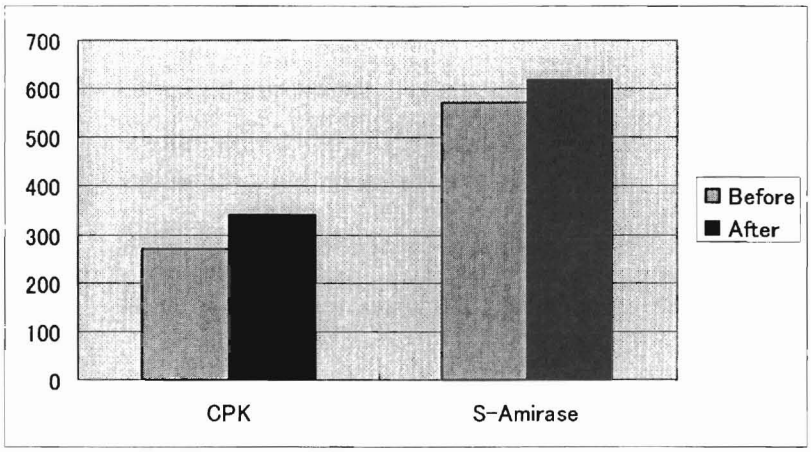

Fig.5 Influence of CPK and S-Amirase supply MF add "ECO CHARCOAL" food in Rats

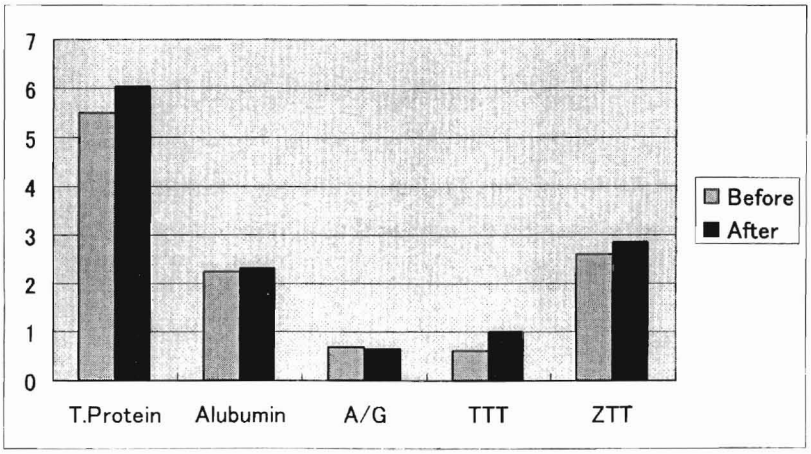

Fig.6 Influence of T. Protein, Alubumin, A/G, TTT and ZTT supply MF add "ECO CHARCOAL" food in Rats

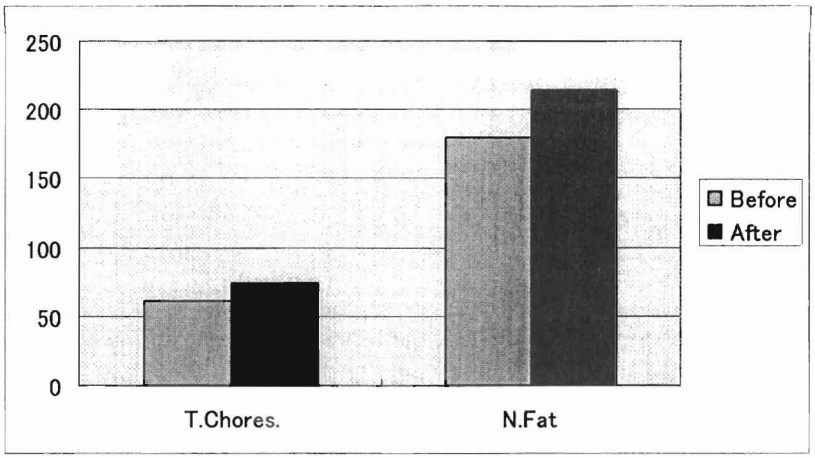

Fig.7 Influence of T. Cholesterol and N.Fat supply MF add "ECO CHARCOAL" food in Rats

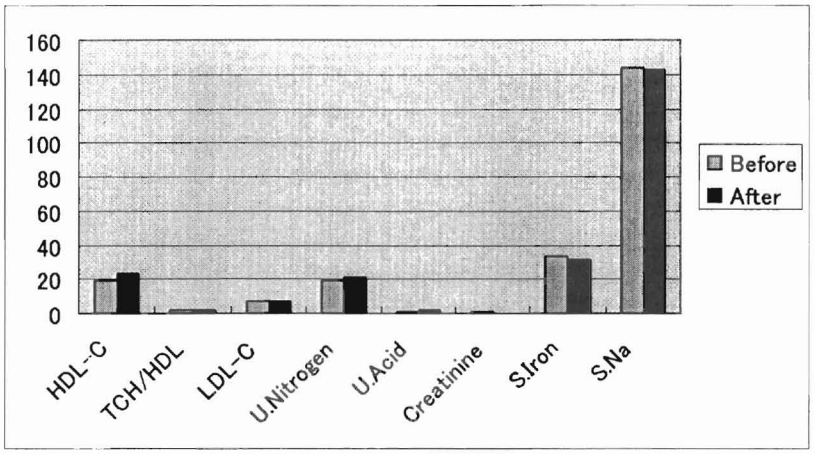

Fig.8 Influence of HDL-C, TCH/HDL, LDL-C, U.Nitrogen, U.Acid, Creatinine, S.Iron and S.Na Supply MF add "ECO CHARCOAL" food in Rats.

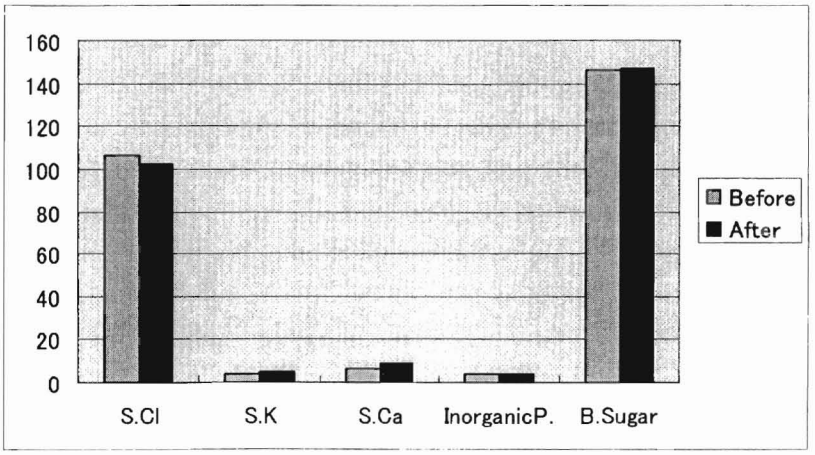

Fig.9 Influence of S.Cl, S.K., S.Ca, Inorganic P. and B.Sugar Supply MF add "ECO CHARCOAL" food in Rats

The values of A/G, serum iron, Na and Cl were a little lower and the values of GOT, GPT, Ch-E, γ-GTP, TCH/HDL, LDL-c, creatinine, inorganic phosphorus were almost the same before and after feeding eco-charcoal. The only item which showed significant difference was the value of LDH ($P<0.01$) after feeding eco-charcoal (see Fig. 3-Fig.9).

Conclusion

The treatment of rubbish coming from everyday life is a difficult problem for local governments and has to be dealt with seriously. The RDF factory of Department of Environment, Kawasaki Iron & Steel Co. Ltd has had great achievement in treating everyday life rubbish. The rubbish first loses its water, and is shaped to form solid pellets. Then in the RDF stove it turns to active carbon called River-eco charcoal, which can be used as fuel and absorbent. The achievement has been making a great contribution to local society for rubbish recycle.

River-eco charcoal is made from rubbish at 800℃ temperature in RDF stove, in which the contents of Mercury, Cadmium, Lead, organic phosphorus, 6-chrom, arsenic, cyanogen, PCB, trichloroethylene, tetrachloroethylen, dichloromethane, carbon tetra-chloride etc, were almost zero, much lower than the standard of fertilizers enacted by Ministry of Agriculture. Furthermore, bacterial and virus examinations were done and all of them were negative. Because of its property, it may be used as material for soil improvement, gas absorbent, water cleanser, reducing agent of iron, and construction. Before used, the question of whether or not this material is safe for human will be asked. For this purpose, the animal safety experiments were designed to test its toxicology, which covered 10 items of blood routine tests and 31 items of blood biochemical tests.

For blood routine tests, apart from the numbers of platelet increasing, the numbers of RBC, WBC, and the values of hemoglobin and hematocrit decreased, but no statistical significant differences before and after fed. For blood biochemical test, although the values of total bilirubin, direct bilirubin, CPK, serum amirase, total protein, TTT, ZTT total cholesterol, neutral fat, HDL-c, TCH/HDL, LDL-c, urea nitrogen, uric acid, creatinine, serum Fe, Na K, Ca, Cl, and inorganic phosphorus, serum glucose had tendency of increasing and decreasing, there were no statistical significant differences before and after fed. The only statistical significant change was the value of LDH, doubling the value of before fed, suggesting it may have sight detrimental effect on liver function.

In this 3-month experiment, animals were fed with 20% of River-eco charcoal continuously. Since River-eco charcoal is not food, and can not be used as food to feed animals in such large amount, so we conclude that in general River-eco charcoal made from everyday life rubbish is safe and harmless material for living animals and human being.

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