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CXXXVI. *Observations on the Action of Animal Charcoal.*
By ROBERT WARINGTON, Esq.

ABOUT twelve months since a friend requested that I would undertake the performance of an experiment for him, which, if successful, he considered might prove of importance. The idea had occurred to him in passing one of the large breweries, that, from the greatly increased demand for pale ale, such as is exported to India, as a beverage for home use, it would be practicable to discharge the colour from the ordinary beer by artificial means, and thus obtain the desired object. What rendered this, he said, the more important, was the difficulty he had heard expressed by persons interested in the matter, in preparing an article sufficiently pale for the purpose of sale, the malt employed requiring to be made expressly for this quality of beer. To effect this desideratum, he considered that all that would be required would be to pass the fluid through a medium of animal charcoal, and that the ordinary amber colour of ale would be thus partially removed. I undertook to make his experiment for him, at the same time telling him that I thought the beer would be rendered very flat and the flavour much injured, but certainly not anticipating what followed. The method adopted, as presenting the least objectionable points to the successful attainment of the desired object, was to pass the cold ale through a stratum of animal charcoal placed on a paper filter, and to re-pass the filtrate through the same medium until the required effect was obtained; the ale operated upon was high-coloured, and had a bitter taste and the fine aroma of the hop. The colour was rapidly removed, but the ale was found on tasting extremely vapid and flat, and the whole of the bitter flavour was found to have been also abstracted. Not being prepared for this result, I was surprised at the rapidity of the action, and resolved immediately to carry on the investigation by substituting other and stronger bitters in the place of the hop. For this purpose a quantity of the ale which had previously had the flavour of the hop removed by charcoal was prepared, one portion of which was boiled with bruised gentian root

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and another with the raspings of quassia wood, but on passing these decoctions when cold through the charcoal filter as before, the whole of the intense bitter flavour which they had imbibed rapidly disappeared.

It now occurred to me that this property of animal charcoal might be made of considerable utility to the chemist, as, from all our information up to the present time, it does not affect the active alkaline organic principles, and therefore should prove the means of separating the bitter of the hop and other materials from that of strychnia or morphia as contained in nux vomica or opium, it being frequently stated that some persons, vendors or makers of this common beverage, are in the habit of adding these and other materials in small quantities to their beer to give it a more intoxicating power. I therefore digested some nux vomica in coarse powder with a part of the ale prepared for the previous experiments, and on passing this when cold a great number of times through the charcoal the bitter flavour still remained, and hence I concluded at the time that my hypothesis was correct. Other engagements broke in on my experiments at this time, and prevented my prosecuting the investigation further.

About ten days since, however, I was recalled to this subject by some other experiments, and tried the effect of animal charcoal on the decoctions of some other astringent bitter substances, as oak bark, Peruvian bark (*Cinchona cordifolia*), and others, all of which had their flavour entirely removed. It may be as well to mention here, that in this second and also in a subsequent series of experiments the animal charcoal was added to the warm solution of the material under trial, and they were digested together on a sand-bath until the full effect had taken place, after which the fluid was passed through a filter. The charcoal used was the ordinary bone-black of the sugar-refiner purified by digestion with hydrochloric acid, washed as long as any saline matter was abstracted, and then dried and heated to low redness. I then tested the extent of this extraordinary power of charcoal by submitting a decoction of aloes to its action, with the same results, the whole of the bitter flavour being removed.

I had proceeded thus far when I was referred by my friend Mr. Henry to a work published at Breslau in 1842, by MM. A. Duflos and A. Hirsch, entitled *Ökonomische Chemie*, where, under the article Beer at page 65, I found nearly all that I had observed described in a few words; namely, that the bitter of the hop, and of all other vegetables used as substitutes for it, as gentian, wormwood, &c., and even aloes, was removed by animal charcoal, but that the bitter of nux vomica, which is often made use of in England, was not affected.

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On looking over my experiments, however, my attention was arrested by finding that the decoction of the bark of the *Cinchona cordifolia* had had the whole of its bitter removed. Now, on the grounds stated in the previous part of this paper regarding the active principle, this should not have been the case. I therefore took a small quantity of disulphate of quina, dissolved it by heat in distilled water, and then added the charcoal, and discovered that the whole of the bitter was removed in less than a minute. A solution of acetate of morphia was also submitted to the action of charcoal with a like result. A watery solution of strychnia was similarly affected, and this made it necessary to repeat my former experiment on nux vomica, which had been made on a cold solution and simply filtering it through the charcoal; it was now digested with the aid of heat, and the whole of its bitter flavour quickly disappeared. The statement of Duflos and Hirsch, on this point, is not therefore entirely correct.

To try the extent to which this abstracting power proceeds, 2 grains of disulphate of quina were dissolved in 2 ounces of distilled water, and animal charcoal gradually added in small quantities to the warm solution until the whole of its bitter flavour was removed; it was found that 12 grains of the charcoal had been required to effect this.

It becomes a matter of surprise that this power of animal charcoal has, as far as I am aware, never been observed before, notwithstanding the frequent and extensive employment which is made of this agent in the preparation of the vegetable alkalies, their salts, and a great variety of other substances of an organic nature, for which it is directed to be used for the purposes of discoloration in all our chemical works and pharmacopœias. Numerous analyses of organic substances, in which it has been employed, will also be open to error on the same grounds.

Before leaving this branch of the subject, I should refer to a paper, and I believe the only one that bears particularly on any of the previous statements, by Dr. Louis Hopff, in the 17th volume of the *Journal de Pharmacie*, p. 172, "On the property of Charcoal in destroying the bitter flavour of many bodies;" in which he gives a series of comparative trials with wood and animal charcoal at a temperature between 78° and 86° Fahr. on solutions of a specified strength, of the extracts of bitter herbs, woods, roots, barks, leaves, flowers and fruits.

I annex a few examples from this paper of substances which have formed the subject of experiment in the present communication, as I believe that the great discrepancies which will be noticed arise from the charcoal employed by Dr. Hopff not having been well prepared.

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	After twenty-four hours.	After forty-eight hours.	After boiling.
Gentian ...	Had lost a little of its bitter.	Purely bitter.	Had lost very little of its bitter.
Quassia ...	Perhaps lost a little of its bitter.	As before.	Lost very little of its bitter.
Aloes	Perhaps a little changed.	A little changed.	As before.
Nux vomica	Very little changed.	Little changed, still very bitter.	Sensibly less bitter.

In a note the author says that the bitter of *nux vomica* disappeared entirely, on agitating its solution with a great excess of animal charcoal.

By analogical reasoning I was led to try the effect of this agent on salts of inorganic constituents, and here a similar action was exerted. A large quantity of sulphate of magnesia was removed from its solution in water, as also of chloride of barium, sulphate of soda and other salts. The fact of sulphate of lime being removed from its solution has I find been already noticed by Payen and Graham.

On laying the preceding experiments before the Society, I stated that I proposed to carry on the investigation, but I have since met, in the number of the 'Chemist' for April, with a translation of a paper by M. Chevallier, "On the action of Animal Charcoal on Metallic Salts," in which he also proposes investigating its action on the *organic salts*. Had I been aware of the existence of this paper at the time, I certainly should not have brought my own experiments forward, and shall not continue the investigation until M. Chevallier has closed his researches. I can only express my regret that I should even thus far have anticipated his results.