IV. *Experiments on Dying Black, by Mr.* James Clegg, *of* Redivales, *near* Bury. *In a Letter to Dr.* Percival.

DEAR SIR,

Redde, Nov. 11, 1773. LIME having been proved to increaſe the ſolvent power of water, upon aſtringent vegetables, for medical purpoſes, I was deſirous of knowing if it would be equally uſeful in the art of dying black; to this end I made the following experiments.

EXPERIMENT I.

Four penny-weights of each of the following aſtringents; videlicet, Galls, Sumach, Oak Bark, Biſtort Root, and Logwood, were boiled during ten minutes, in half a pint of pure river water; upon mixing the decoctions with a ſaturated ſolution of martial vitriol, in the proportion of $\frac{1}{3}$ of the ſolution to $\frac{2}{3}$ of the decocton, they ſtruck colours differently inclining to blackneſs, in the following order; videlicet, Oak Bark, Biſtort Root, Sumach, Galls. I then boiled the ſame weight of all the aſtringents, in the ſame quantity of lime water; and upon mixing them as

as above, the colours they produced were inferior to thoſe with plain water, the aſtringency of the logwood, or whatever gives it the property of ſtriking black with green vitriol, was entirely deſtroyed; it produced not the leaſt blackneſs with any quantity of vitriol.

EXPERIMENT II.

Four penny-weights, of each of the aſtringents above-mentioned, were tritured in plain water, and four others in lime-water; the meaſures of water uſed were equal to thoſe left, after boiling, in the laſt experiment; and, upon being mixed with martial vitriol as in the laſt experiment, the colours produced, by this means, were ſuperior to thoſe produced by boiling. Thoſe tritured in lime-water were judged to be the deepeſt, which agrees with Mr. HENRY's experiments; but we muſt again except the Logwood, which gave no colour by trituration, more than by boiling in lime-water.

EXPERIMENT III.

All the above mixtures, having been written with as inks, and expoſed ſix months to the air; thoſe boiled in lime-water had failed much; thoſe tritured in lime-water, and in plain water, had faded a little; thoſe boiled in plain water evidently preſerved their colour beſt.

Upon ſlightly rubbing the faded writings, with a freſh aſtringent liquor, they recovered their ori-

ginal blackneſs; by which it appears, that it was the aſtringent parts of thoſe Inks which had failed.

Does it not appear, by theſe experiments, that, though lime-water tends to deepen the colour produced by ſome aſtringents and martial vitriol, it by no means adds to the duration of thoſe colours; and as lime-water, either by trituration or coction, entirely deſtroys the property, in logwood, of ſtriking black with martial vitriol, it can by no means be of ſervice, in the black dye, where logwood is a material ingredient.

Does it not alſo appear, that a ſlight boiling is preferable to trituration, for the purpoſes of dying, when a durable colour is wanted?

Having obſerved a ſolution of iron, in a *vegetable* acid, ſtruck a deeper black, upon mixture with an aſtringent, and produced its effect much more expeditiouſly, than a ſtrong ſolution of martial vitriol; it occurred to me, that the iron, being more ſlightly combined with the vegetable acid, than with the vitriolic, made it more eaſy, for the aſtringent matter to decompound the former, and produce an ink; if this was the caſe, I ſuſpected, that lime-water deepened the colour of aſtringent and chalybeate mixtures, not ſo much by its action upon the aſtringent, as upon the chalybeate, the lime uniting with the ſuperabundant acid, and leaving the iron, with ſo much of the acid, as is neceſſary for the formation of an ink, to be more eaſily attached by the aſtringent matter of the vegetable.

But

But if this theory was well founded, it followed, from analogy, that any ſubſtance, which had a greater affinity with the vitriolic acid than iron had, would produce the ſame effect, in ſome degree, as lime. To determine this:

EXPERIMENT IV.

I took two veſſels, containing equal meaſures of a ſtrong aſtringent liquor, compoſed of galls and logwood; into one veſſel I put a ſmall quantity of pearl aſhes; the other remained as a ſtandard. Pieces of linen and cotton cloth, after maceration in theſe liquors, were thrown together into a ſtrong ſolution of copperas; they were ſoon after taken out, and waſhed in cold water; when dry, the pieces prepared in aſhes were, all of them, much deeper than the others.

I made uſe of different kinds of pearl and pot-aſhes, as well as of many kinds of aſtringents; the aſhes had the ſame effect, whatever aſtringent was made uſe of, and the ſtrongeſt alkali always produced the deepeſt colour; and though aſhes, uſed with an aſtringent, always gave a deeper black, than the ſame aſtringent without aſhes, yet logwood, which without aſhes gave not ſo deep a colour as galls with them, gave a much deeper black than galls with the ſame addition.

There was a remarkable difference, in this caſe, betwixt lime and aſhes, in their effect upon logwood; with lime it gave no blackneſs, but with aſhes it produced a deeper black, than any other aſtringent I made uſe of.

Being deſirous of trying the duration of colours, produced by aſtringents, in which different quantities of pearl aſhes had been diſſolved;

EXPERIMENT V.

In two pints of river water, I boiled one ounce of logwood, during ten minutes; I then added half an ounce of Aleppo galls, and boiled them together ten minutes longer; the liquor having ſtood to cool, was decanted off, and divided into ſix equal quantities. N°. 1 remained as a ſtandard, into N°. 2 I put ſix grains of fine pearl aſhes, N°. 3 twelve grains, N°. 4 eighteen grains, N°. 5 twenty-four grains, N°. 6 thirty grains; to ſix drops of each of theſe liquors, I added two drops of a ſaturated ſolution of copperas; N°. 2 and 3 ſtruck a deep black, N°. 1 and 4 black, but inferior to 2 and 3, N°. 5 a brown black, N°. 6 brown.

From this experiment it appears, that N°. 5 and 6 were ſpoiled by an over proportion of aſhes. Before I had the pleaſure of ſeeing your experiments, wherein you demonſtrate, that a quantity of acid enters into the compoſition of ink, I imagined the alkali decompounded the copperas too ſuddenly, and diſengaged the iron faſter, than the aſtringent matter could unite with it.

But, moſt probably, the alkali neutralized too great a portion of the acid.

All theſe writings having been now expoſed ſix months to the air, in N°. 5 and 6 the blackneſs is quite

quite deſtroyed, N°. 4 is ſomething faded, N°. 1, 2, 3, remain nearly as they were, N°. 2 and 3 being ſtill ſuperior to the ſtandard.

I am,

Your moſt obliged,

humble ſervant,

Redivales, May 18, 1773.

JAMES CLEGG.