ON A
NEW METHOD
OF PREPARING
PHARMACEUTICAL EXTRACTS.

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COMMUNICATED

BY DR. MARCET.

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IT has not failed to be matter of regret with medical men, that many of the pharmaceutical extracts, although prepared from materials of the same quality, vary considerably in their efficacy, in consequence of having suffered partial destruction in the process of inspissation. This has justly been attributed to the excess of heat employed in their preparation ; and it seems also to be generally allowed, that the presence of atmospheric air, by affording oxygen during the process, is injurious. There are some other circumstances attending the common mode of evaporation, which likewise operate as minor causes of uncertainty in their efficacy, such as the degree of agitation or stirring

bestowed on the fluid; the surface exposed and the depth of it in the evaporating vessel; but especially the quantity operated on at a single process, as on this must depend the duration of the destructive causes. Considering all these as concurring circumstances, we are forced to admit, that it is scarcely possible to produce two different parcels of an extract by the common method, which shall each possess the same efficiency. Hence, a disparity in the effects of these medicines does frequently occur; and independently of the evil arising from the use of inferior materials, this disparity is the ground of just objection to the use of extracts, from the natural reluctance a medical man feels to administer remedies, the strength of which he has no standard to ascertain; and this objection is rather increased by the circumstance of our being unable to separate, by any purifying process, the efficacious part of an extract from the part which has become inert. Solution, crystallization, or precipitation, means which yield us superior advantages in the preparation of saline and metallic substances, are here of no avail. It has therefore long been a desirable object to possess means less exceptionable than those hitherto in use, for the preparation of this class of medicines; and conceiving that a method of my own (which has been carried into execution on a large scale, and is free from the chief objections to the common process) is possessed of some practical utility, I have thought the subject would have

sufficient weight to entitle the present communication to the attention of this Society.

By the present nomenclature of pharmacy, the term *extract** is applied to the inspissated residua of vegetable solutions ; some of these solutions are imperfect, and the residua obtained from them must in every case be of a very compound nature. These solutions are natural, being the expressed juices of plants ; or artificial, consisting of decoctions or infusions of vegetable substances. The menstruum in general is water ; but of the latter description some few are alcoholic mixtures. Most commonly the menstruum is intended to extract all the active ingredients ; in a few cases it is designed to dissolve but certain parts of them ; and with respect to the inspissated juices, the utility which they should possess, is that of presenting in a concentrated and durable form, the medicinal virtues of the recent juices. Our business then in forming an extract, is to reduce to a solid state the medicinal part of the solution ; to withdraw the menstruum, and preserve in the residuum the same efficacy in kind and degree which the solution possessed, except such as depends on matter, which, in a chemical sense, is volatile. And some plan which shall accomplish this is what we seek ; perhaps it is attainable : if however perfection is not to be expected, still, if a process which presents the means of producing the extract of uniform quality can be

* Except in the instance of the *extractum elaterii*.

offered, it will secure what is certainly our principal object.

In order to prevent the injurious effects of heat on medicinal extracts, I proposed some years since, in conversation on the subject, to conduct the evaporation in vacuo. The low temperature at which fluids are known to boil in exhausted vessels, together with the supposed advantage this plan possesses of preventing the access of oxygen, led me to expect decidedly good effects from its execution.

The subject selected for the first experiment was a solution of opium. The next was some juice of hemlock. Both of these were evaporated in a water-bath, the vessels having been exhausted by an air-pump; and the products exhibited appearances, which left no doubt of the superiority of this method for preparing extracts. Accordingly I decided on carrying the project into execution at some future day; and on shewing a sketch of the necessary apparatus to my partner William Allen, I had the satisfaction of finding that his opinion supported my own. Soon afterwards it was submitted to my friend Dr. Marcet, who not only gave it his approbation, but so strenuously advised its adoption, that it was concluded on to have the vessels constructed on a large scale. It is remarkable, that only a short time before the large apparatus was made, this

gentleman received from Professor Jaenisch, of Moscow, a communication on the same subject, proposing to prepare extracts in vacuo. Dr. Marcet thought it proper on that occasion, to advise my not being informed of the plan of the Moscow Professor, till my own apparatus was finished.

To persons acquainted with the process of Edward C. Howard for refining sugar, and for which he took out a patent, it may appear that I have but small claim to invention, for proposing a very similar process to obtain extracts. The two kinds of apparatus are however materially different. I employ no pump, or machinery, but produce the exhaustion wholly by steam; and the vacuum is maintained in my vessels by immersion of the whole in water*. The difficulty with which air is prevented from finding its way into exhausted vessels, seems the chief impediment to conducting evaporation in vacuo. This difficulty, by the simple expedient just mentioned, is completely remedied. The apparatus being thus rendered easy of management and less expensive, appeared likely to be employed in some other large manufactures, such as sugar-refining and colour-making; and on that account I have been induced to take out a pa-

* This idea, original with myself, was some time since publicly made use of for a particular object; and lest I should be supposed to have borrowed it from the invention alluded to, I may here take leave to say, that its adoption, in that instance, was the result of my own advice.

tent for it. It is, however, to be recollected by this Society, that I have declined having a patent for its pharmaceutical products. Chemists, desirous of inspissating extracts in vacuo, are therefore at liberty to do it in any apparatus differing from that which has been made the subject of my patent; and thus these substances may continue the objects of fair competition as to quality and price.

Notwithstanding the disadvantageous circumstances which generally attend inspissation in the open air, I have little doubt that many of the extracts might be obtained in that way, of very superior, though perhaps not of uniform strength, by complying with certain conditions, which are, however, suited only to the scale of philosophical experiment, or the consumption of an individual practitioner. But it is well known that the trouble attendant on these preparations, renders it much more convenient to purchase than to make them. Hence it has become the business of the druggist to supply extracts; and making them on a scale proportionate to his demand, he is obliged, in order to produce rapid evaporation, to subject them to a temperature, little, if at all, short of 212° , one that seems to be decidedly injurious. This happens even when the steam-bath or the water-bath is employed; and extracts so prepared must still be considered as having been partially subjected to the contingencies before-mentioned. In fact, it may be stated on good authority, that

extract of rhubarb, for instance, when inspissated in vacuo, is fully twice as effective as when boiled down in the open air over steam.

Any improved method then for extracts to become really useful, must be adapted to the large scale of manufacture; and this is one of the features of the method which I propose, for it admits of being carried into effect to almost any extent, and with a proportionate diminution of cost.

As perhaps it will be satisfactory to the Society to form for themselves a judgment upon the fitness of the method I have adopted, and of the apparatus by which it is carried into effect, I propose here to describe them both. The mode of procuring the vacuum, and the manner of maintaining it, have already been mentioned. The degree of exhaustion is of course judged of by the column which is supported in the mercurial gage; and I think it will excite some surprise, when it is stated, that although no pump is employed, yet that column is often at a height of 28 inches during rapid ebullition. In fact, it is common to operate with a column not two inches less than the barometer of the day, and at such times the temperature of the boiling fluid is below 100° Fahrenheit, often at 95°; and I am satisfied that by certain improvements this temperature may be reduced to less than 90° in the ordinary process of manufacture. The vessels employed in

the apparatus first put up, were two; the one of cast iron, polished on its inner surface, serving as the evaporating pan, and situated in a water-bath, may be called *a still*. The head of it leads into the second vessel, which is a large copper sphere, about three times as large as the other, and surrounded at pleasure by cold water; it may be called *the receiver*. In the pipe which connects these two is a large stop-cock, by which their communication with each other can be suspended. The manner of setting it to work is this: the juice or infusion is introduced through a large opening into the polished iron still, which is then closed, made air-tight, and covered with water. The stop-cock which leads to the receiver is also shut. In order to produce the vacuum, steam is allowed to rush through the copper sphere, until it has expelled all the air, for which five minutes is commonly sufficient: this is known to be effected by the steam issuing uncondensed. At that instant the copper sphere is closed, and the steam shut off; and then cold water admitted upon its external surface. The vacuum thus produced in the copper sphere, which contained about four-fifths of the air of the whole apparatus, is now partially transferred to the still by opening the intermediate stop-cock. Thus four-fifths of the air in the still rushes into the sphere, and the stop-cock being shut again, a second exhaustion is effected by steam in the same way as the first was: after which a momentary communication is again al-

lowed between the iron still and the receiver; by this means four-fifths of the air remaining after the former exhaustion is expelled. These exhaustions repeated five or six times, are usually found sufficient to raise the mercurial column to the height before-mentioned. The water-bath in which the iron still is immersed, is now to be heated until the fluid that is to be inspissated begins to boil, which is known by inspection through a window in the apparatus, made by fastening on air-tight a piece of very strong glass; and the temperature, at which the boiling is kept up, is determined by a thermometer. Ebullition is continued until the fluid is inspissated to the proper degree of consistence, which also is tolerably judged of by its appearance through the glass window. I prefer taking for a single operation, as much juice or infusion as will keep the apparatus employed for nearly the whole day. When inspissated sufficiently*, the residuum, which we denominate extract, is taken out and is fit for use.

On comparing the temperature employed for ebullition in vacuo with that generally in use, we are led to expect a considerable difference in the sensible qualities of extracts. With some this is the case in a very striking degree. The extract of hemlock is an example; its taste and smell are

* It frequently happens that the extract has become too stiff; but this is easily remedied by gently warming it, and kneading it with sufficient water.

remarkably different, as is the colour both of the soluble and feculent parts ; it also possesses an extraordinary degree of tenacity, a property which is not generally found in the common extract ; and it abounds so much with crystallized matter as to produce a gritty sensation when rubbed between the fingers. The extract of belladonna contains a large quantity of crystals of some kind of salt ; but I have not succeeded in procuring either of these in a separate state, so as to give them an examination. In some attempts to obtain them pure, and more particularly to discover whether morphia (the new vegetable alkali) was traceable in the narcotic extracts, I became acquainted with the singular fact, that phosphoric acid in a soluble state is to be found in all the extracts. On further extending the investigation, it was ascertained that this acid, besides that portion of it which exists as phosphate of lime, is contained in a vast variety of vegetables. It would be rather foreign to the subject of this paper to enumerate the substances that were tried, but I may just mention that all those vegetables which are cultivated seem to contain phosphoric salt in great abundance.

The extract of taraxacum is another remarkable instance of the difference in the sensible qualities of these preparations ; instead of being sweet to the taste and high-coloured, like that prepared in the common way, it is bitter and extremely pale when fresh made ; its taste much resembles that of the plant it-

self. With respect to the strength of extracts made in vacuo, I have not yet gained sufficient information to be able to present a view of the relative proportions which they bear to the common extracts; but I have been informed by several medical friends, who have given them a trial, that they find them materially stronger*. Perhaps some gentlemen will consider the subject sufficiently deserving of investigation, to collect such a statement of cases as will enable them to present to the Society, the relative doses. I shall be glad to offer for the acceptance of such, specimens of any kind, which they may be inclined to make use of.

*Plough Court, Lombard Street,
25th of 5th Month (May) 1819.*

* I deem it almost indispensable to state, that the increased activity of extracts when prepared by this new method, makes it imperative on those who compound medicines to continue using the old kind, except where extracts prepared in vacuo are specially prescribed.

- A Iron still, or evaporating-pan.
- B Water-bath.
- C Steam-pipe to heat this bath.
- D Thermometer indicating the internal temperature.
- E One of the covers, in which is a glass aperture.
- F Pipe leading from the still to the receiver.
- G Mercurial column to measure the degree of exhaustion.
- H Stop-cock.
- I Cock for admission of air.
- K Receiver in the refrigerating vessel.
- L Cock for drawing off the condensed water.
- M Cock for admitting steam when the air is to be expelled.