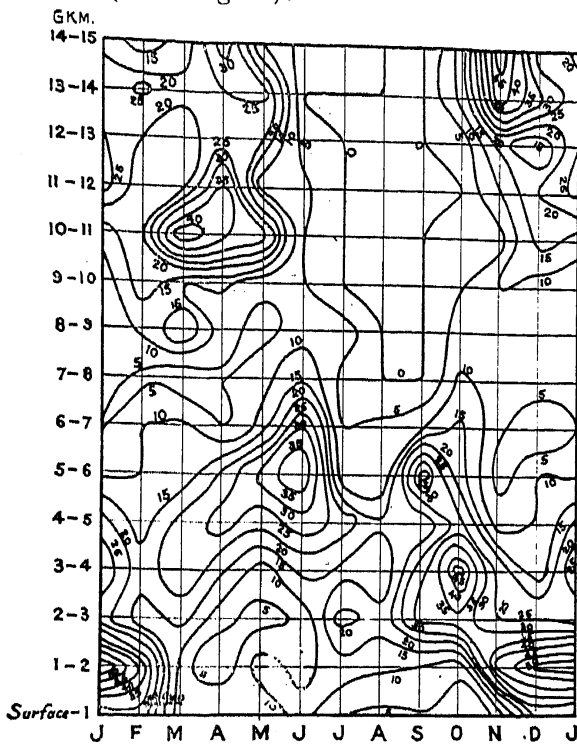


(5) Large frequency of occurrence of inversions and isothermal layers above 10 gkms. in the non-monsoon months (vide Fig. 2).



Isopaths of percentage frequency of inversions and isothermals over Agra.

FIG. 2

(6) Very pronounced inversion at the tropopause in the monsoon months but less pronounced inversion at that level, in the non-monsoon months (vide Fig. 3).

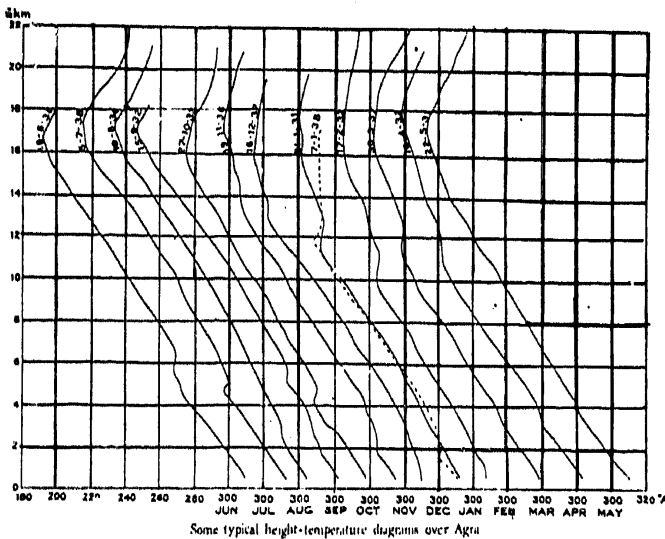


FIG. 3

(7) Occurrence of a very pronounced maximum in the annual range of temperature over Agra at 9 gkms. and of a less pronounced maximum at 18 gkms. (vide Fig. 4)

A detailed paper on the subject is being published as a *Memoir of the India Meteorological Department*. The investigation was completed in April 1942, but the paper could

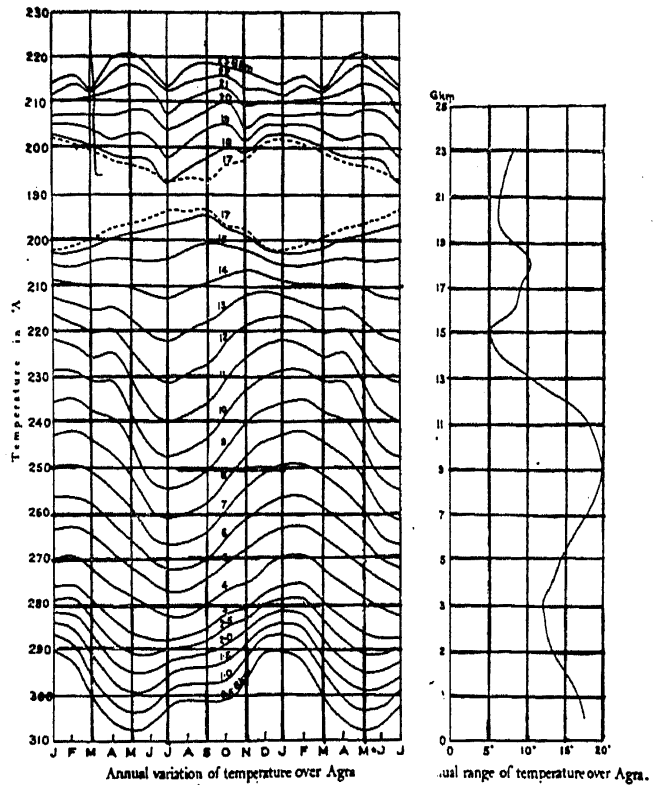


FIG. 4

not be published on account of war-time restrictions.

Meteorological Office,  
Upper Air Section,  
Poona 5,  
October 29, 1945.

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### TAMARIND SEED PECTIN

In a previous publication<sup>1</sup> it was reported that when an aqueous extract of tamarind kernel is treated with twice its volume of alcohol, a voluminous fibrous precipitate is obtained and that it forms a well-set jelly in acid medium, when mixed with an appropriate amount of sugar. On account of this characteristic property the substance was designated as pectin. The material as obtained by this method usually contains 14 per cent. of proteinous matter, some carbohydrates, and a little combined phosphorus, and the removal of these associated substances, especially the proteins, is often difficult and tedious. It has now been noticed that if, instead of using the seed flour as the starting material, pounded seeds (size of a sweet pea) are taken for extraction, most of the proteins and fibres remain with the swollen seeds and the pectinous matter passes into solution, giving a purer material. By dissolving in water to form a thin solution, centrifuging and subsequently precipitating with alcohol, the pectinous substance containing below 1.5 per cent. of protein is easily obtained. Further lowering of the protein content is possible by repeating the operations a few times. Final purification may also be effected by preparing

either the copper or the barium compounds and regenerating the substance.

The aqueous solution of the pure material is dextrorotatory and does not reduce Fehling solution. It has a very low acid number.<sup>2</sup> In its colour reaction with iodine the substance differs considerably from starch. When only a few drops of iodine are added to 0.5 per cent. solution, a bright yellow colour is formed; but with excess a greenish blue colour is produced. The latter colour, however, changes to yellow almost at once, if diluted with water. The substance yields metallic compounds with cupric ammonium sulphate, Fehling solution, barium hydroxide and basic lead acetate, which separate out from water as flocculent precipitates. Purified through any of the salts by treatment with appropriate acid, it retains in full the jelly-forming properties. On addition of borax its aqueous solution is readily converted into a thick gel.

Nanji *et al.*<sup>2</sup> have shown that tamarind seed pectin differs from fruit pectins in properties and composition. Our experiments also lead to similar results. Unlike fruit pectin it does not contain any uronic acid nucleus or methyl ester grouping. Our further experiments show that on hydrolyses with 5% sulphuric acid it yields xylose, galactose and glucose and on oxidation with nitric acid, mucic and saccharic acids as the primary products. But we have not been able to get *l*-arabinose amongst the products of hydrolysis or repeat the other data reported by Damodaran and Rangachari.<sup>3</sup>

Tamarind seed pectin seems to resemble seed-pectins more than fruit-pectins. The seed pectin, for example, from coffee, does not contain any uronic acid nucleus but on the other hand is reported to yield galactose and pentose on acid hydrolysis and mucic acid on oxidation with nitric acid.<sup>4</sup> Experiments aiming at the elucidation of the constitution of tamarind seed pectin are in progress, and the details will be published elsewhere.

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Dehra Dun,  
August 1, 1945.

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#### A NEW METHOD FOR MEASURING THE TIME OF SETTING OF GEL- FORMING SYSTEMS

SEVERAL methods have been suggested for the measurement of the time of setting of gel-forming systems which is the main property characterising a gel. The setting condition has been variously defined such as the approach of a certain value of viscosity or the attainment of a constant value of some optical property. The viscosity methods employ certain criteria involving a number of arbitrary experimental conditions. For instance, Flem-

ming's method<sup>1</sup> requires that the container must be filled up to a particular volume; Hurd and Letteron's method<sup>2</sup> requires that a particular length of rod of a specific diameter should be dipped at a particular angle in the gel-forming solution; if Fells and Firth's method<sup>3</sup> is employed, it is necessary that the air bubbles should be blown at a particular rate or pressure. If these conditions are changed, different values of the time of setting are obtained. Further, in the methods involving viscosity considerations, the gel-forming system as a whole has to be disturbed several times during measurement, this disturbance being the least in the case of Hurd and Letteron's method. Methods involving the actual measurement of viscosity should give values far from truth because these measurements, by any method, involve continual disturbance of the gel-forming system. This disturbing factor is wholly eliminated if optical properties are employed, but it has been shown that methods depending upon these properties are inapplicable in the case of systems which are either optically void or highly opaque. The authors have devised a method in which the least disturbance is given to the gel-forming system and no arbitrary conditions are prescribed.

When a body is made to vibrate up and down in a liquid, ripples are produced which spread outward along the surface of the liquid, and become feebler, through attenuation, as the circles become larger, and their amplitude is reduced as they progress. The logarithmic decrement of these ripples depends upon the resistance offered by the liquid, the damping effect. In the case of a gel-forming system, the resistance is predominantly offered by the viscosity of the system which increases during setting. This will increase the logarithmic decrement, and will, therefore, decrease the distance travelled by the ripples. The propagation of the ripples will stop when the viscosity becomes very high. Hence, if ripples are produced in a gel-forming system, they will be propagated quite freely in the beginning; in course of time, the distance travelled by them will decrease and after a certain time no ripples will be propagated. This condition would, therefore, indicate that the gel has set.

The actual experimental conditions were realised by means of a ripple projector provided with a stroboscopic arrangement. The gel-forming solution was contained in a watch-glass, and the height of the vibrating fork was so adjusted that the gel-forming system as a whole was not disturbed. It was observed that initially the ripples spread over a large area, but their size diminished as the setting point is approached and the propagation stopped completely when the gel had set. The time taken by the gel-forming system to reach this condition has been taken as the time of setting. The diminution in the extent of the area to which the ripples spread can be seen from the disappearance of the ripples from the far end, and by noting the successive disappearances of the several ripples it is possible to surmise the velocity of gelation of the system,