

**Advances in
Reclamation and
Reconstitution of
Filled Wax**

1992

1993

ADVANCES IN RECLAMATION AND RECONSTITUTION OF FILLED WAX

Presented at the 22nd European Conference on Investment Casting, Paris, 1992

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A review is given of a comprehensive approach to wax reclamation technology, with especial reference to filled waxes. At a time when economic and environmental factors are becoming increasingly important, the paper examines how the concept of reclaim and reconstitution of wax can be applied to both runner systems and patterns.

Introduction

Traditionally investment casters have usually viewed reclaim wax as being suitable only for runner systems. However with Blayson Olefines' sophisticated approach to reclamation technology there are signs that this is set to change. Major economic and environmental considerations are leading foundries to explore the use of reclaim and reconstituted wax for runner systems and patterns, irrespective of whether they use unfilled, emulsified or filled wax. These considerations offer investment casting foundries important cost savings of up to 25% of their annual wax expenditure and this paper is aimed at highlighting some of the technical points that should be viewed in considering the process.

It must be said that Blayson Olefines as a wax manufacturer and wax reclaimer has always produced reclaimed wax to an agreed specification with the customer. As a matter of quality control, only the customer's own blend of wax is processed and returned for their re-use. Also reclaim and reconstitution of unfilled or emulsified wax is a process that has always been carried out. However now with the quality control coupled with more advanced technology, it has enabled Blayson to reclaim and reconstitute filled wax within a specification to that of virgin wax and therefore offer a positive step forward in wax technology.

Critical points to consider in reclaim and reconstitution of filled wax.

First it may be useful to define what we mean by the term reclaim and reconstitution of filled wax. We are referring to a process whereby a foundry's autoclaved filled wax is thoroughly cleaned, dewatered and restored by addition to the same agreed specification as the original virgin wax. To achieve this result satisfactorily a series of critical points must be considered, as shown in figure 1.

Figure 1. Critical points when considering reclaim and reconstitution

- a) Approve a wax that contains necessary materials for reconstitution.
- b) Imperative to use virgin wax that will resist oxidation.
- c) Use non-sticky virgin wax to help reduce silicon release requirement.
- d) Ensure only one base wax is used in foundry's wax system.
- e) A separate runner wax of different base should not be used in the system.

At this point it is necessary to mention that all work on filled wax referred to in this paper has been carried out on Blayson Olefines FR range of filled wax.

- (a) As a start it is necessary for the foundry to approve a filled wax compound that will of course contain the necessary materials that will allow reconstitution.
- (b) It is imperative to use a virgin filled wax that will resist oxidation. If a wax is to be reclaimed and reconstituted and used again for pattern production, it is important to use a wax that will not oxidise with heating or continuous use. It should not separate and break down causing dimensional variation, surface finish problems and changes in flowability etc.
- (c) Use of a non-sticky virgin filled wax is a further major consideration. It is an advantage to use such a non-sticky wax from the FR range to enhance easy removal of the wax pattern from the die, but equally importantly it reduces or in some cases eliminates the need for silicon release agent. This reduction in the use of silicon cuts down on a potential source of contamination during the reclaim and reconstitution stage. It must be stressed however, if a silicon is used then it must always be thoroughly washed from the wax before being re-used or sent for reclamation.
- (d) Having decided on the most suitable grade of FR filled wax for use it is necessary to ensure that only one base wax material is in the foundry's wax system. Mixing pattern wax with different wax bases will contaminate the reconstituted blend and therefore cause possible variations in the specification of the material. Of course mixing pattern wax compounds of the same base wax will not present such a problem.
- (e) A separate runner wax should not be used in the system unless it is of an FR base. All material for reclamation should be sent to Blayson for processing, so as to avoid contamination form elsewhere, and then specific quantities of the used wax can be divided into material for reclamation as runner wax and/or material to be reconstituted for pattern wax.

Quality control on wax for reclaim and reconstitution

The advanced technical characteristics of an FR type filled wax will allow the process of reclaim and reconstitution to work. Of course quality control, testing and adjusting back to specification by additions are a vitally important part of the procedure. However it is equally important for the foundry to have a general appreciation of wax reclamation and quality control for the process to be completely successful. A foundry must develop controls on the quality of wax it generates for reclamation and some of the examples are shown in the following table – figure 2.

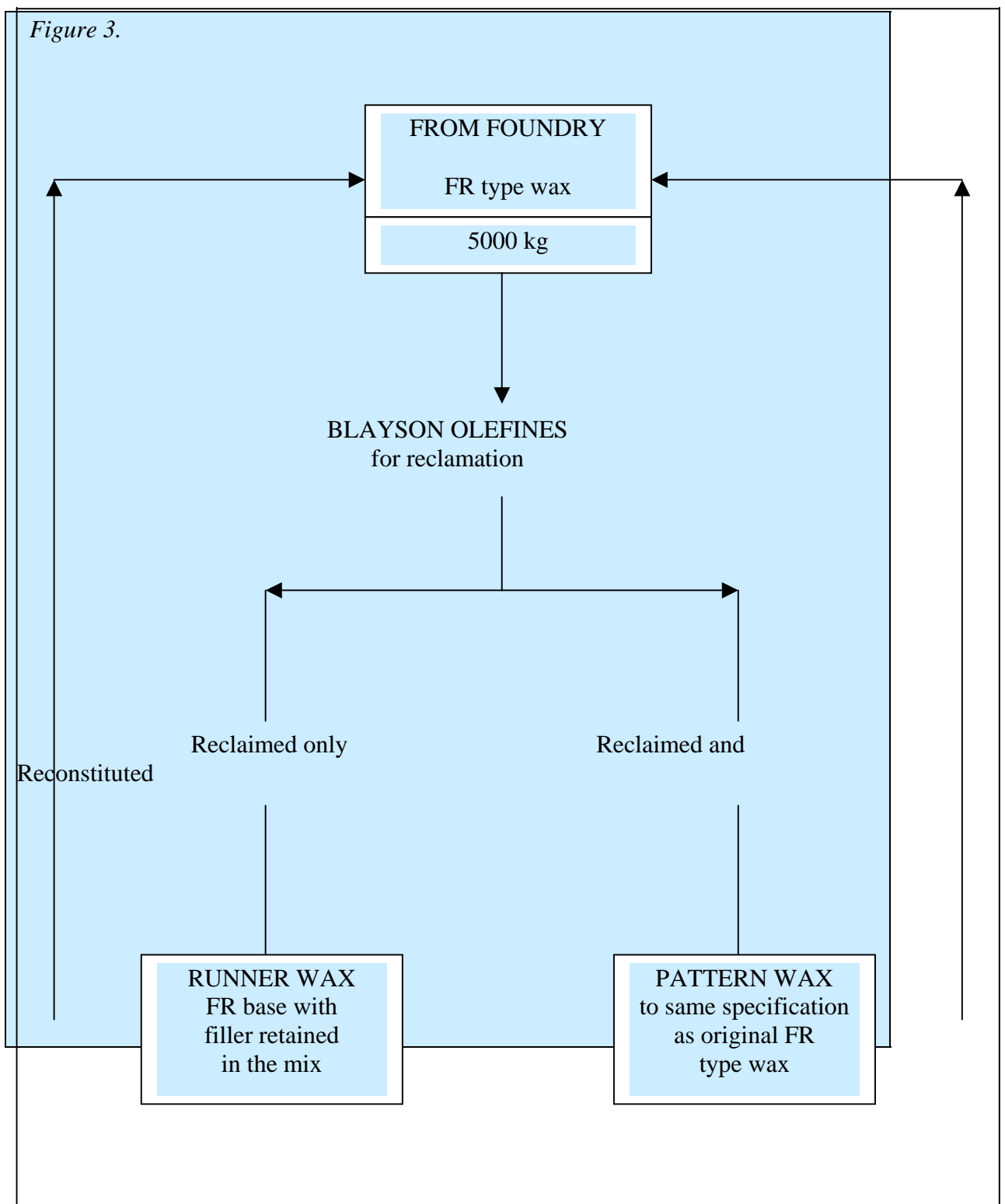
Figure 2. Controls on wax for reclaim and reconstitution

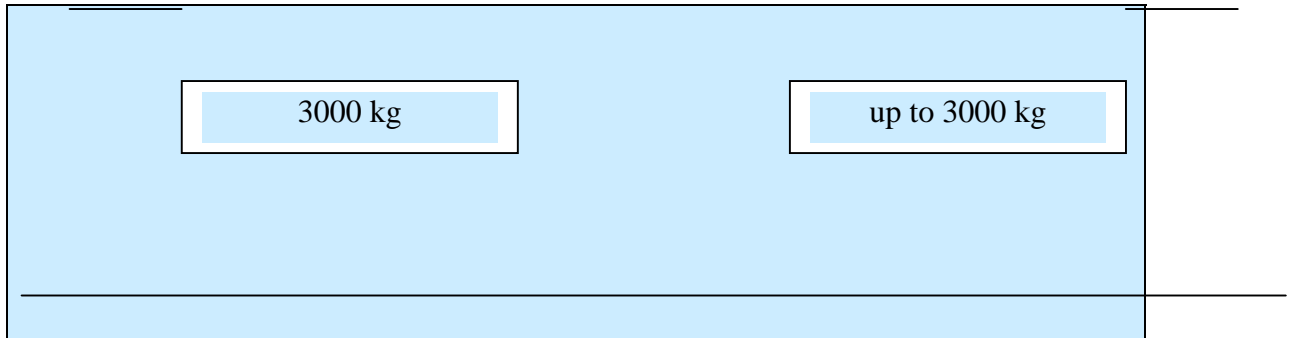
- a) Waste products must not be mixed with the wax, e.g. foundry floor waste, boots, gloves, bottles, cans and broken shell etc should be kept separate.
- b) The amount of silicon used in the process should be reduced as far as possible.
- c) Water mixed with the wax during dewaxing should be kept to a minimum.

- d) The use of a simple filter cloth placed over the autoclave tray can prevent ceramic sand entering the wax during the dewaxing process.
- e) The size of autoclaved wax blocks should be considered to enable easy packing onto pallets and to make optimum use of transport.
- f) The wax blocks should be strapped and wrapped to further reduce the chance of contamination while being stored or during transportation.

Processing of autoclaved filled wax for reclaim and reconstitution

The flow chart shown in Figure 3 indicates the way in which autoclaved wax can be treated during the process of reclaim and reconstitution.





Quality control procedures are no different to those applied to virgin wax except for some additional tests required by the reclamation route. Wax from the foundry is firstly melted down and water and extraneous matter are eliminated from the wax. The filler material is thoroughly cleaned and blended back into the final compound. The reclaimed wax can then follow one of two routes. It can either be returned as runner wax or be reconstituted to a pattern wax specification and then returned to the foundry.

(a) Reclaim wax for runner systems.

When considering reclaim for runner systems, Blayson usually recommends reclaiming and retaining the filler material still suspended in the final product. This gives the following advantages to the runner wax.

1. Improved injection flowability
2. A quicker setting wax
3. A more stable wax with less distortion

If it is necessary the runner material can be modified in agreement with the foundry to reduce melting point and to give flowability of the wax when dewaxing.

(b) Reclaim and reconstituted wax for patterns.

Providing the guidelines as previously stated are followed at all stages then results of reconstitution are very good. A complete variety of wax patterns can be produced in reconstituted wax and examples of these are shown in the slides.

(c) Monitoring reclaim and reconstituted wax.

It is of course extremely important that the wax manufacturer maintains total quality control over the process. The incoming material from a foundry would be tested and any recommendations necessary would be made regarding the general condition of the wax. During the subsequent processing of the wax, various standard tests would be carried out. For example, ash content, congealing point, penetration, viscosity, filler and water content would all be determined. From the results additions are made in order to reconstitute the wax back to the specifications of the original virgin material. Dimensional test results obtained for reclaim and reconstituted wax have proved that it has the same dimensional repeatability as the virgin FR range of wax.

Some typical results of comparisons of virgin wax against reconstituted wax are shown in the following figures 4, 5, 6 and 7.

(d) Possible yields

As a guideline on yield, a foundry returning 5000 kilos of dewaxed FR type material would receive back approximately 3000 kilos of reclaim runner wax with filler retained in the blend and anywhere up to 3000 kilos of reclaim and reconstituted wax for use on patterns. Naturally the exact quantities would depend on the amount of water and waste in the autoclaved wax and the actual ratio of runner to pattern wax required by the foundry.

Conclusion

Without doubt such sophisticated reclaim and reconstitution technology of FR filled wax offers the investment casting foundry enormous cost savings. As the time goes on, the positive environmental factors obtained from the process also offer the foundry considerable advantages as they endeavour to move forward into the future.

Figure 4: Ash results

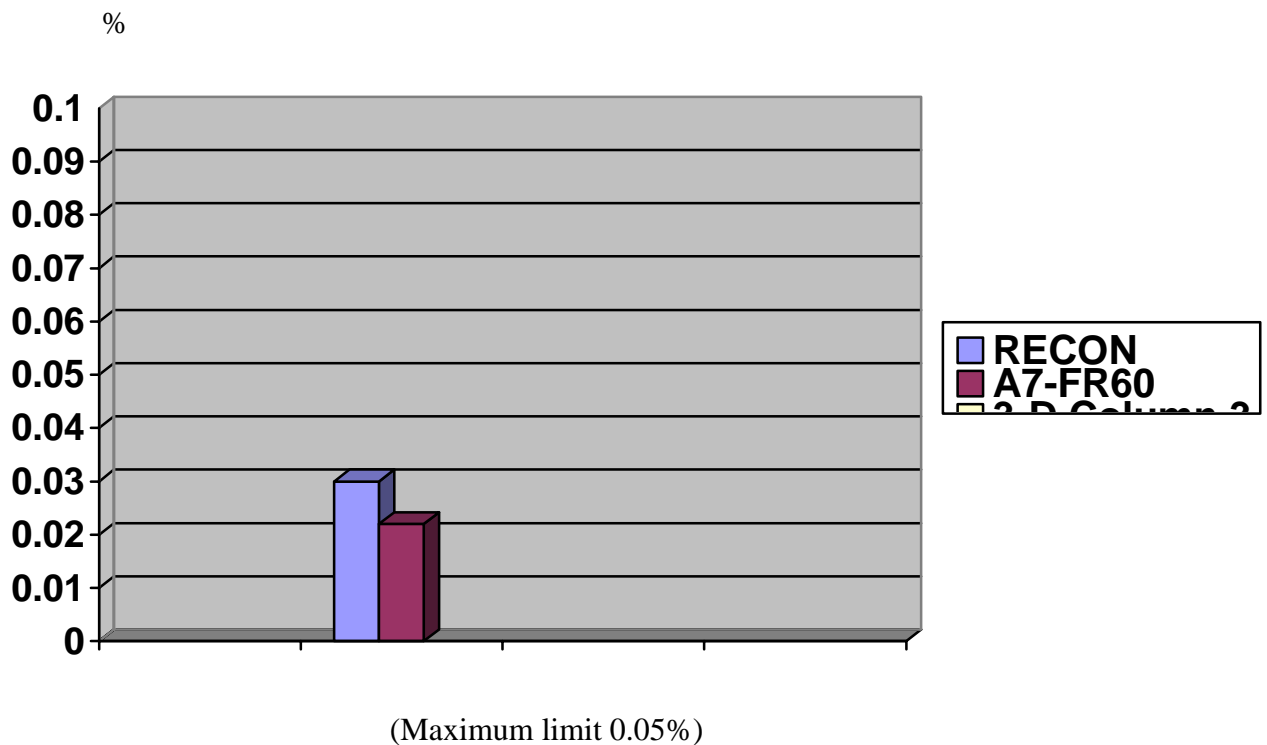
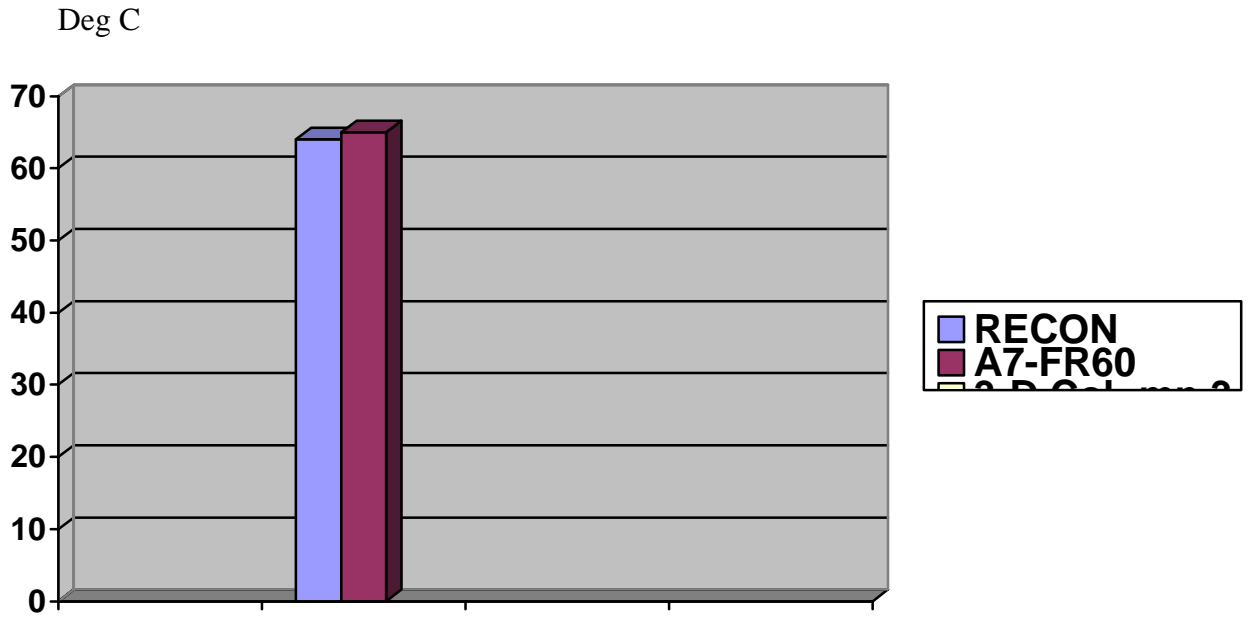


Figure 5: Congealing point



*Figure 6: Relative penetration results
(25°C / 5sec / 200gm)*

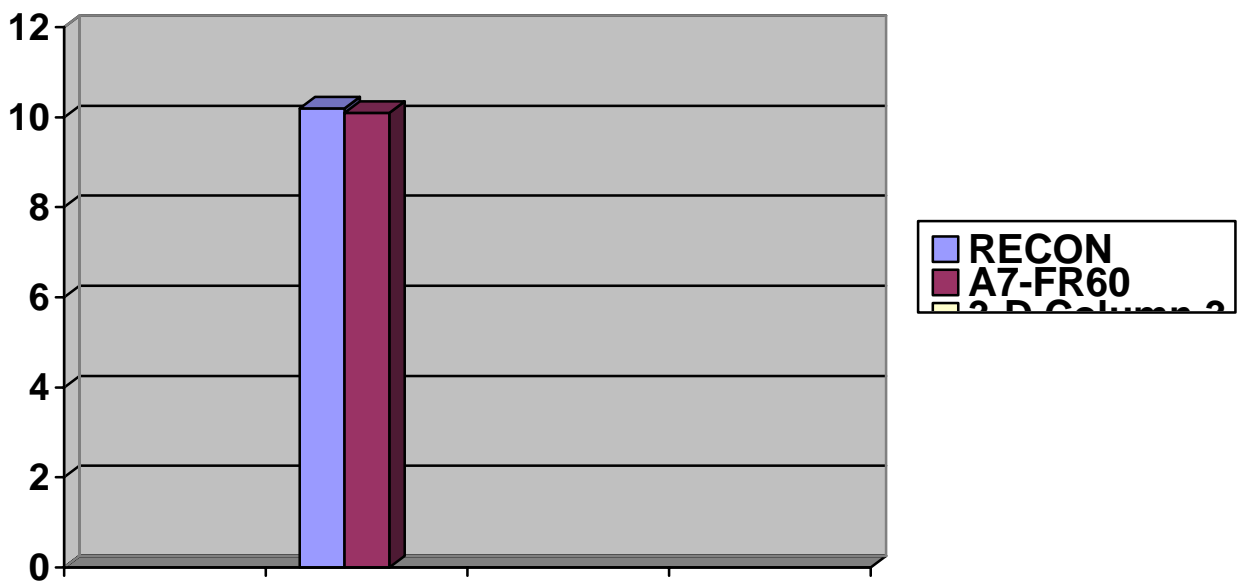
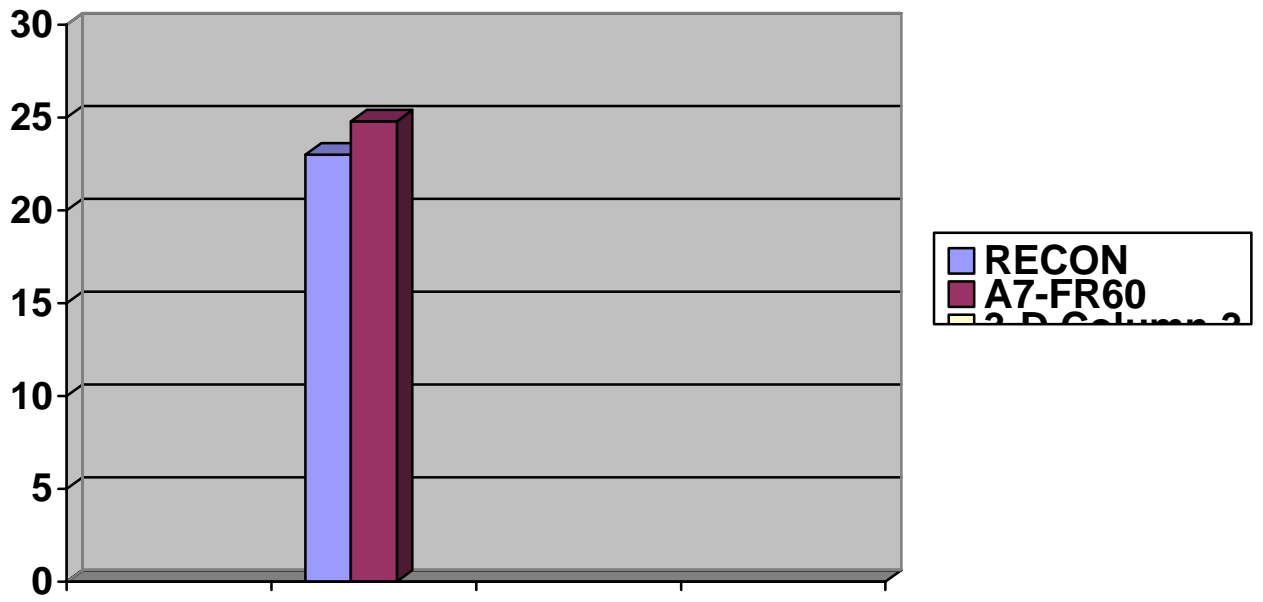


Figure 7: Viscosity results

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