An introduction to optical polymer research, inc. and a qualitative method for the identification of rigid contact lens materials

Dr. Paul Shuman

It is a great pleasure to be here today to join with you in the celebration of the 25th aniversary of the Clínica Barraquer. I would like to express a special congratulations to Drs. Barraquer and Henao who 25 years ago made it possible for us all to join with them in celebrating this day. And also to congratulate all those who contributed to the hard work that made the Clinic known through out the world for it's great contributions to the science of optometry and opthomology and for its great service to the people of Colombia.

I am honored to be invited to speak here today and to be able to make a small contribution to this celebration by presenting a short paper that may be of some help to those who manufacture and to those who fit contact lenses.

Most of you are aware of the fact that there are many different rigid contact lens materials being manufactured and sold throughout the world. I would estimate the number to be close to 100 different materials and since the expiration of the controlling silicone acrylate U. S. patent, the number of new materials continues to increase. I would further estimate that 90% of all rigid lens materials now in use are either polymethylmethacrylate (PMMA), silicone acrylates, or fluorine modifield silicone acrylates. With all the different rigid lens materials available, quality control becomes a problem for the lens laboratory and even more so for the lens fitter. This is further complicated because many of the lens blanks are unmarked.

As presented at the "Forum in anniversario Instituto Barraquer de América, 21-26 marzo 1993"

Because of this quality control problem I would like to offer a relatively simple but useful method for the separation and qualitative identification of rigid contact lens materials. As you will see, this is a non-destructive test that may be used, with some limitations, to characterize rigid contact lenses and contact lens blanks, this test is based on the differences in contact lens material densities as shown in my first slide.

Some representative contact lens materials have been arranged in an order of increasing density. This is not an exhaustive list but does serve to illustrate the density range of some of the more commonly used rigid lens materials. The lowest one shown, No. 1, is for O ->perm 30 having a density of 1.086 G/CC with the highest one for equalens, No. 20, having a density of 1.266. You can also see that equalens, PMMA and RXD are in a class by themselves, having a density much higher than the other RGP materials shown. As a consequence of this they are easily separable from all other RGP lens materials above them on this list. On line 19 is shown the density of a saturated solution of sodium chloride in water, or common table salt, which has a density of 1.197 g/cc..

If we were to prepare such a solution and place on the surface of the solution a mixture of lenses or lens blanks selected from this list we would find that all the lens materials 1 through 18 would float and the RXD lens blank or lens would sink. Now if we carefull continue to add water to the salt solution the equalens lens blank or lens would sink and on continuing to add water the PMMA lens or lens blank would sink.

Table 1

DENSITY OF SOME RIGID CONTACT LENS MATERIALS

1.	O-Perm 30	1.086	31.
2.	PARAPERM 02+	1.096	27.
3.	SGO II	1.103	20.
4.	BOSTON IV	1.104	22.
5.	OPTACRYL 32	1.109	16.
6.	VISTAFLEX 50	1.111	17.
7	O-PER 15	1.112	15.
8.	SGP Y	1.113	13.
9	VISTAFLEX 25	1.113	9.
10.	VISTAFLEX 100	1.117	30.
11.	O-PERM F40	1/120	38.
12.	FLUOROPERM 30	1.123	24.
13.	OPTACRYL 18	1.124	9.
14.	O-PPERM F60	1.132	62.
15.	FLUOROPERM 60	1.135	47.
16.	BOSTON	1.135	13.
17.	PMMA	1.189	0.12
18.	EQUALENS	1.191	47.
19.	SATURATED SALT SOLUTION	1.197	
20.	RXD	1.264	27.

At this point you would have prepared two solutions that would separate RXD, equalens and PMMA from the other RGP listed.

If this process were continued it would be possible to sucessively separate each of the materials with the exception of the two equal density pairs 8 and 9 and also pairs 15 and 16. This limitation of the process could be easily minimized with a selective, limited choice of materials used in the lens laboratory or the practioners office. A graphical presentation of the separation process is shown on the next slide showing a density/concentration curve for the solution of sodium chloride in water. On the top part of this slide is shown density limits that we have found for a large number of silicone acrylates and fluorine-containing lens materials. As you will notice there are overlaping densities for the two classes of lens materials but for the most part the fluorine-containing lens materials have higner densities than the silicone acrylate lens materials. Superimposed on the solubility curve is shown the separation process just described. The saturated solution density line separates RXD, in the lower corner, from the remaining materials, equalens and the O-> perm series show the point where the material density matches that of the salt solution. The addition of a small amount of water at each of the densities shown the lens material will sink.

Recently, one of our customers mixed 0->perm 15 and 30, it was a very simple matter to prepare a solution having a density of about 1.1 g/cc and to separate each of theses materials. This same separation would have easily been possible without knowing the two densities involved.

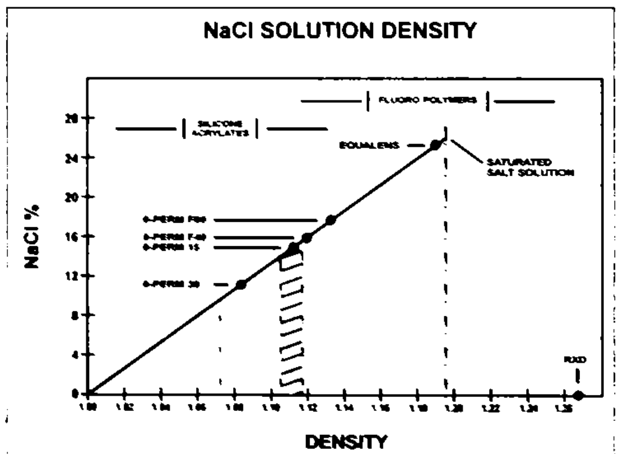

Figure 1.

In conclusion I would like to say that I hope that this process will be of some help in your quality control efforts and also in your future selection of RGP lens materials.