

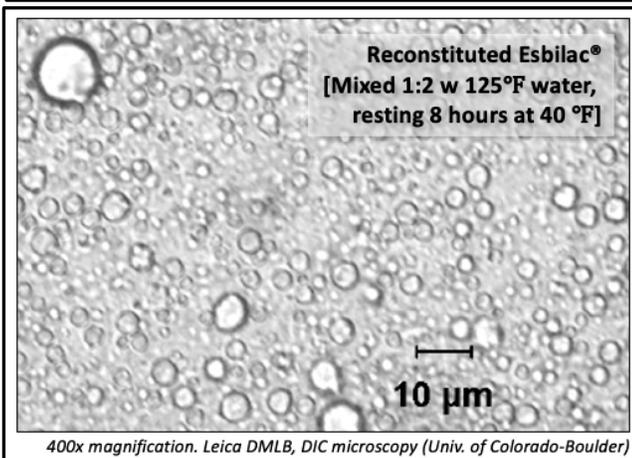
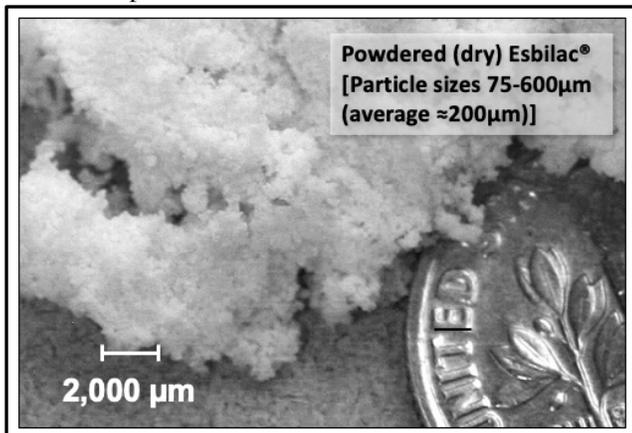
## **PREPARING FORMULA - RESTING AFTER MIXING IMPROVES RECONSTITUTION 90%+**

By Allan & Shirley Casey

The label instructions on the common milk replacer powders used by rehabilitators specify to: add the powder to water; mix; then use - with the implication that the formula is immediately ready to be fed to the wild mammals. Many people do feed the formula immediately, while others allow it to 'rest' in the refrigerator for 1 to 8 hours before feeding. WildAgain conducted a series of tests to see if extra time made any difference. The results showed significant improvement in powder dispersal when the formula was allowed to rest for 8 hours - ranging from 67.5% to 96.8%, with an average of 90.6% improvement over all of the samples tested (both individual powders and blends of powders).

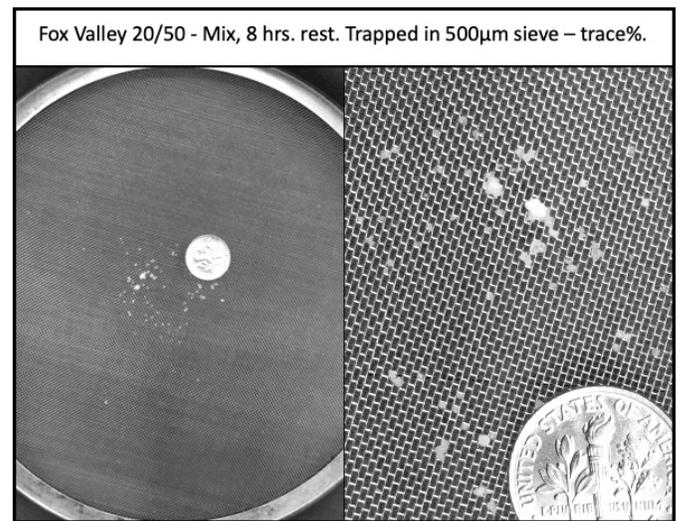
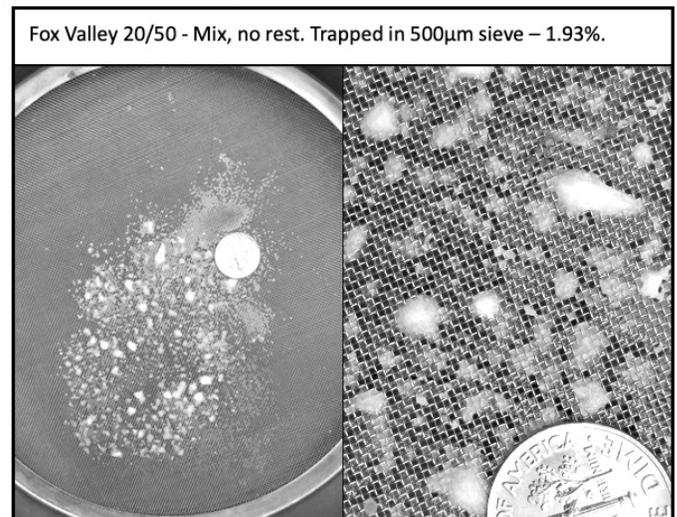
The manufacturer's instructions produce a white, milky looking liquid. However, at this point, with just a simple stir, is the formula sufficiently reconstituted to be fed to very small nursing mammals? The scientific literature as well as WildAgain's testing suggests the answer is no.

Fortunately, improvements are easily achievable with a few extra preparation steps. Consider the image below that illustrates the magnitude of the challenge of transforming dry particles ranging from 75-600 $\mu\text{m}$  in size to liquid particles 2-3 $\mu\text{m}$  (and smaller) in size. It is a little more complicated than just adding water and simply mixing to achieve the optimal result.

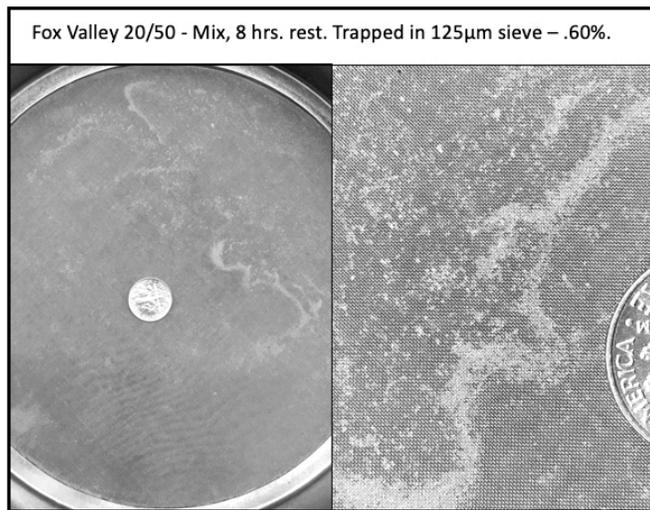
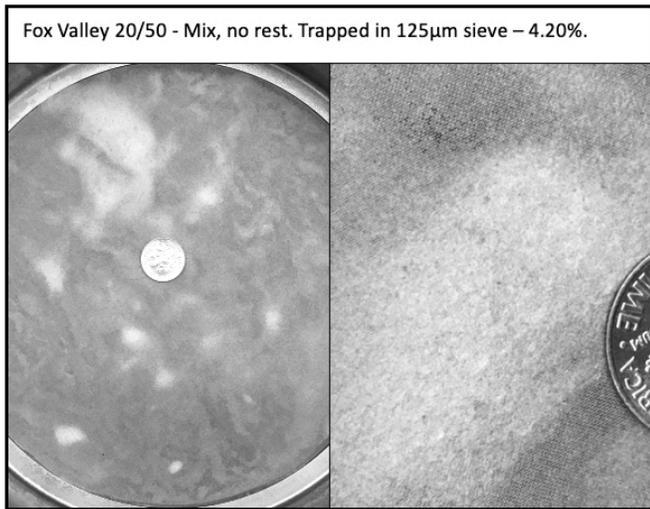


The images below are for the tests of Fox Valley 20/50 (which improved by 96% with resting). Two batches of the powder were mixed 1:2 with water and mixed for one minute to prepare formula. One batch was immediately poured through three stacked 8" diameter sieves with successively smaller mesh sizes (500 $\mu\text{m}$ , 250 $\mu\text{m}$ , and 125 $\mu\text{m}$ ) to capture any undissolved milk particles that did not fully reconstitute. The second batch was allowed to rest in the refrigerator for 8 hours, and then poured through the sieves. The fewer particles trapped by the sieves indicates more complete reconstitution of the powders.

This first set of images shows the amount of unwetted, dry powder that was trapped in the 500 $\mu\text{m}$  sieve at the two time periods - instant mix and then after 8 hours of resting. As shown, there was clear benefit in terms of a more complete reconstitution of the particles of this size.



The next set of images show the same procedure for the 125 $\mu\text{m}$  sieve at the two time periods - instant mix and then after 8 hours of resting.



Once again, the tests show there is clear benefit from allowing the formula to rest and allow for more complete powder/particle dispersal and fuller reconstitution.

The following table shows the results for the same tests performed on other milk replacer products. The percentages indicate the amount (by weight) of the dry and unwetted powder captured (retained) by each sized sieve. As shown, if not allowed to rest after mixing, an average of 11.5% of the dry powder has failed to wet and disperse below the 125 $\mu$ m particle size and is retained by the sieves. When allowed to rest for 8 hours, there is a 90%+ improved reconstitution, with only 1.0% retained, on average.

Reconstitution dispersal test - % of powder (by weight) retained by each sieve									
Sieve size ( $\mu$ m)	Instant mix - no rest				Mix - 8 Hours rest				Improvement
	500	250	125	Total	500	250	125	Total	
GME®	4.0%	1.6%	0.7%	<b>6.3%</b>	0.0%	0.0%	0.2%	<b>0.2%</b>	<b>96.8%</b>
Zoo33/40+FV40/25	7.1%	1.1%	4.0%	<b>12.1%</b>	0.0%	0.1%	0.3%	<b>0.4%</b>	<b>96.7%</b>
Zoologic® 33/40	13.1%	0.2%	0.7%	<b>14.1%</b>	0.3%	0.0%	0.3%	<b>0.5%</b>	<b>96.2%</b>
FV20/50	1.9%	7.4%	4.2%	<b>13.5%</b>	0.0%	0.0%	0.6%	<b>0.6%</b>	<b>95.6%</b>
Zoo33/40+FV32/40	3.2%	7.7%	6.7%	<b>17.6%</b>	0.0%	0.2%	0.7%	<b>0.9%</b>	<b>94.7%</b>
KMR®	3.9%	0.6%	2.3%	<b>6.8%</b>	0.3%	0.1%	0.3%	<b>0.6%</b>	<b>91.2%</b>
FV40/25	8.4%	0.7%	5.5%	<b>14.6%</b>	0.0%	0.0%	1.7%	<b>1.7%</b>	<b>88.6%</b>
FV32/40	1.3%	3.5%	5.7%	<b>10.5%</b>	0.0%	0.0%	1.3%	<b>1.3%</b>	<b>87.9%</b>
Esbilac®	0.8%	1.0%	5.8%	<b>7.6%</b>	0.3%	1.1%	1.1%	<b>2.5%</b>	<b>67.5%</b>
<b>Average</b>	<b>4.9%</b>	<b>2.6%</b>	<b>4.0%</b>	<b>11.5%</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.7%</b>	<b>1.0%</b>	<b>90.6%</b>

The obvious question is why is this important? And what happens if the particles remain too large and fed to neonates and small juveniles?

The chart at right shows the relative sizes of certain objects to liquid milk. For reference, “A” represents the average size of Fox Valley dry particles; “B” KMR®; and “C” Esbilac®. As shown, 50% of liquid milk particles are less than 1 $\mu$ m in size. The tests described previously

Size or Diameter	Reconstituted powdered milk (wet)	Comparative sized objects	
.1 $\mu$ m	Reconstituted % of total	Cooking smoke	
1 $\mu$ m			50%
10 $\mu$ m			37%
100 $\mu$ m	13%	Dust mite waste	
250 $\mu$ m	Dry milk particles	Human hair	
1mm (1,000 $\mu$ m)			Dust mites
1.25mm		Poppy seed	
		Sand grain	

(Drawing not to scale!)

are measuring amounts of powder that have not reconstituted at 125 $\mu$ m and larger. Feeding a formula with particles 10 to 100+ times larger than the solids in mother’s milk (that are mostly 1 $\mu$ m or smaller in size) would likely provide significant digestive challenges to very young animals with immature and still developing digestive systems.

### Conclusion

Rehabilitators should be providing a substitute milk formula that not only closely matches the composition of mother’s milk and is fed in the appropriate amounts at proper intervals, but also a formula that has been prepared to achieve a high degree of complete and full reconstitution. The tests show PetAg® and Fox Valley milk replacers are not “instant mix” products despite label assurances. It falls to the user to take the extra steps when preparing the formula to enhance product performance in terms of digestibility, absorption and utilization in immature digestive tracts.

The test results discussed above indicate significant and repeatable improvements in milk replacer dispersal/reconstitution by simply mixing the formula at least 8 hours of resting in the refrigerator prior to use. Additional beneficial steps are described on WildAgain’s website, e.g., using fresh product; proper storage of the powders (unopened and opened); using room temp powder and hotter water for mixing; and enhanced mixing techniques (since these products demonstrate poor wetting and sinking characteristics.)

(A more thorough discussion of this issue is posted at WildAgain Wildlife Rehabilitation Inc’s website: [www.ewildagain.org](http://www.ewildagain.org). © 2020 Allan and Shirley Casey. Reprinted with permission.)

Allan and Shirley Casey have been licensed wildlife rehabilitators since 1986. Co-founders of WildAgain Wildlife Rehabilitation, Inc., they conduct research, publish, and conduct training on a variety of wildlife rehab related topics, including nutrition, health, regulations.