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Coffee Stirrers and Drinking Straws as Disposable Spatulas

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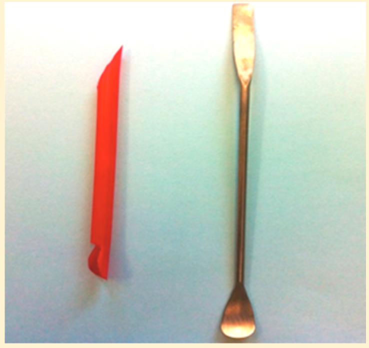
ABSTRACT: Although metal spatulas are damaged through everyday use and become discolored and corroded by chemical exposure, plastic drinking straws are inexpensive, sterile, and disposable, reducing the risk of cross-contamination during laboratory procedures. Drinking straws are also useful because they come in a variety of sizes; narrow sample containers such as NMR and EPR tubes can easily be filled using small diameter coffee stirrers, whereas bulk material can be transferred using larger drinking straws. Several types of drinking straws and coffee stirrers were cut at various angles and the amount of material picked up in a single scoop was massed 30 times. Standard deviations of the 30 measurements per straw indicate that approximately the same amount of material will be transferred each time by the same operator.



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One of the major concerns in chemistry laboratories is the cost of labware.[1−3] Use of household and improvised items in place of expensive laboratory counterparts has therefore been in practice.[1,2,4,5] We have found that using straws cut at an acute angle in place of spatulas in teaching laboratories decreases the cost and increases the effectiveness of scooping devices, as well as solves the difficulties caused by using damaged or corroded metal spatulas.

Drinking straws and coffee stirrers are readily available and have been suggested as replacements for traditional spatulas in amateur and grade school laboratories.[3,4] Because straws are inexpensive and disposable, they can also be used in research as well as teaching laboratories of all levels.[1,2,6,7] The cost of a box of 500 drinking straws is approximately \$6.00 and a box of 1000 coffee stirrers is approximately \$5.00,[8] whereas a typical pack of only 12 metal spatulas is around \$50.[9]

Metal spatulas are damaged through everyday use, becoming discolored by certain chemicals such as sodium chloride and solid metal phthalocyanines and corroded by chemical exposure. Inexpensive straws can be rinsed or simply thrown away after a single use. Because they are so easily replaceable, the risk of cross contamination is minimized.

The curved sides of the straw prevent the spills that students often experience while using flat spatulas. This is particularly important when weighing in an enclosed analytical balance. The use of plastic straws also decreases the risks associated with transferring shock-sensitive materials. In our laboratories, small diameter coffee stirrers have proven particularly useful for filling narrow sample tubes such as EPR tubes, whereas larger diameter drinking straws are more useful for transferring bulk material.

To test the effectiveness of using straws as spatulas, several types of drinking straws and coffee stirrers were cut with a sharp, thin bladed knife at acute angles (Figure 1), and the amount of sodium chloride transferred in a single transfer was measured; this measurement was repeated 30 times with each straw by a single operator. The scoopula end of smoothie spoon straws 9 and 11 were also used for measurements. Smoothie spoon straws cost approximately \$10 for 400 straws,[8] and can hold several grams of material in a single transfer.

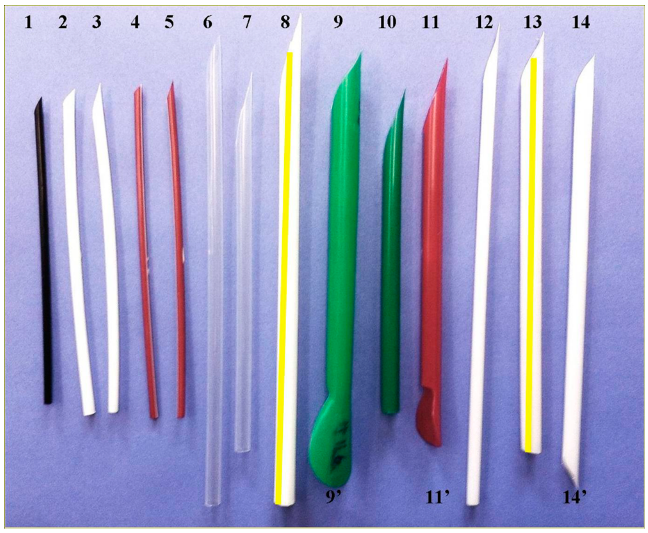

Figure 1. Fourteen straws cut for use as disposable spatulas.

FINDINGS

The average mass picked up by each straw are compiled in Table 1, along with information about the type, diameter, and the angle of the cut straw. In most cases the standard deviation was less than 15% (last column). The consistency of the measurement was verified by cutting each end of a particular

Table 1. Straw Characteristics and Amount of Material Per Scoop

Straw Type and Color	Straw Number	Diameter, mm	Angle of Cut, °	Average Mass Transferred, g	SD Values	SD Difference, %
			Coffee Stirrers			
Black	1	2.1	28	0.0432	0.0067	16
White	2	3.9	40	0.0955	0.0077	8
	3	3.9	20	0.0754	0.0104	14
Red	4	2.8	38	0.0182	0.0032	18
	5	2.8	19	0.0359	0.0032	9
			Drinking Straws			
Clear	6	5.4	21	0.3284	0.0447	14
	7	5.2	14	0.3945	0.0333	8
Striped	8	7.3	15	1.0613	0.1345	13
	13	7.3	28	0.7802	0.0637	8
Green	9	11.3	26	2.2522	0.2733	12
Dark Green	10	7.0	19	0.9082	0.0578	6
Red	11	6.8	18	0.8715	0.0546	6
White	12	4.8	12	0.4365	0.0287	7
	14	5.4	29	0.4556	0.0382	8
	14′	5.4	29	0.4208	0.0306	7
			Plastic Scoopula			
Green	9′	11.3		5.2739	0.4396	8
Red	11′	6.8		1.6380	0.0986	6

Notes: Results based on 30 measurements for each straw by a single operator. See Figure 1 for images of the straws.

straw to the same angle and using each end to perform the analysis (straws 14 and 14′).

As expected, a straw with the same diameter and cut angle produced similar average masses over their respective 30 measurements; Straw 14 has an average mass of 0.4556 g, whereas Straw 14′ has an average mass of 0.4208g. This indicates good reproducibility for a single operator. Note that even when the angles are different the masses are similar. Figure 2 shows that there is a gradual increase in capacity with increased diameter. Standard deviations of the 30 measurements per straw indicate that approximately the same amount of material will be scooped each time by the same operator.

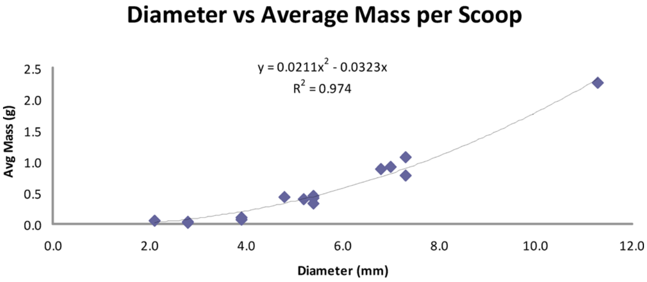

Figure 2. Diameter of straw versus average mass per scoop. The trend line assumes a y intercept of zero.

There is, however, variation in mass when the operator intentionally changes the angle of the straw's insertion into the salt, and when different operators use the same straw. Further, the mass transferred is also dependent on the density, crystal size, and adhesion properties of the material being transferred. For example, the mass of boric acid transferred with Straw 1 and Straw 2 were 0.0282g and 0.0535g, respectively, or 65% and 55% of the amount of sodium chloride transferred with the same straws.

CONCLUSIONS

The coffee stirrers, straws, and scoops included in this study have a capacity between 0.018 g to over 5 g. With practice, it is possible for an individual to estimate how much of a particular material he or she expects to pick up in a single scoop using a straw of a given diameter. This would allow an operator to transfer approximately the amount of solid material needed prior to massing on an analytical balance. Because this transfer can be performed away from the balance, there would be a reduction in spillage on, and damage to, delicate equipment.

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Notes

The authors declare no competing financial interest.

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