# Dosage by volume using Ernest

**updated in December 2021**

**This somewhat long document presents a variety of topics**

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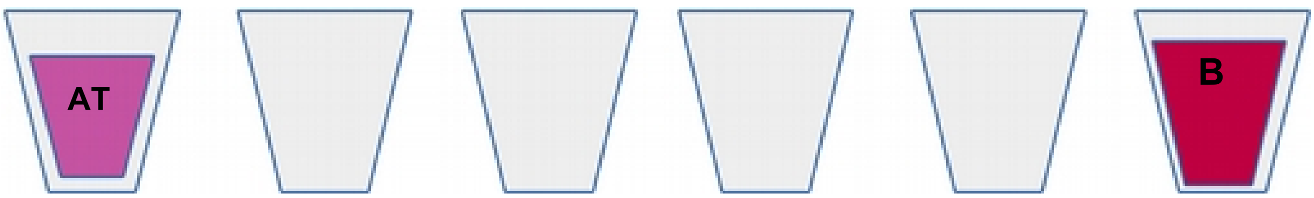
Volume dosing allows much faster glaze testing than weighing samples one by one. There is a precision which may be slightly less accurate than individual weighing but is much less prone to making errors. We will be using graduated syringes in three sizes: 1 ml, 3 ml and 10 ml. (Remember that ml stands for milliliter, and 1 ml of water weighs 1 gram). We can also measure by drops. It takes 20 drops of water to make 1 ml , but to make a usable size sample of glaze it would take too many drops and would be needlessly complicated and slow.

**Notations**

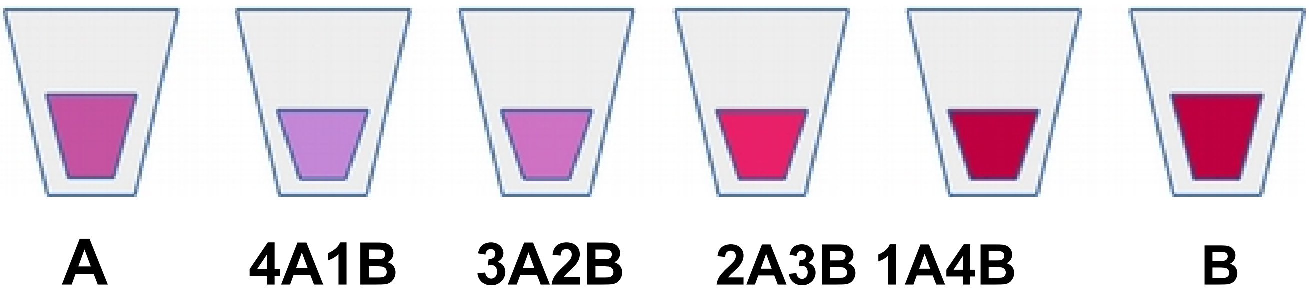
We will be using some shorthand notations with Ernest to make it easier to read.
For a mixture of ingredients “A” and “B” with 3 parts “A”, and 2 parts “B”, we will notate it as 3A2B.
When we are working with a glaze with 4 ingredients, “A”, “B”, “C”, and “D”, you might see a note calling for 2A1B1D, which is indicating 2 parts of ingredient “A”, 1 part “B”, and 1 part “D”.
As there is no “C” mentioned in the formula, it should be understood that the amount of part “C” added should be zero.

## Application to online progression

**For example, we want to see the influence of a material in a basic recipe. For example, we will want to see what happens when we add titanium to a recipe. Prepare 10 g of this basic recipe and add 10 g of water. We therefore obtain 20g of wet glaze. We divide into two equal parts (or by weighing or by volume) which we put in two cups A and B; there will therefore be 10 g of glaze in each cup, ie 5 g of dry matter per cup. In well B we will add titanium, for example we will add 8% (these 8% are calculated on the dry matter) or 0.4 g of titanium. We blend. Now if we want to make 6 samples for our progress we will have 6 cups**




**and we are going with a syringe to distribute in the 4 empty cups of enamel A and B to have this:**




**Our notation indicates that in the first empty glass we will put 4 doses of A and one dose of B**

**in the second empty glass we will put 3 doses of A and 2 doses of B in the third empty glass we will put 2 doses of A and 3 doses of B etc.**

The dose here could be 0.5 ml here. We will use a 3 ml syringe and we will put in the first empty glass 4x0.5ml or 2ml of A, then 1.5ml in the next glass, then 1ml etc. We will do the same thing for B in the other direction. After mixing, the tests are carried out with a brush, which will be noted in pencil oxide A, 4A1B, 3A2B, etc. As the maximum addition was 8% titanium, this means that sample A contains 0% titanium, 4A1B contains 8% divided by 5 (we have 5 intervals because 6 cups) The cups therefore contain 0% titanium, 1.6%, 3.2%, 4.8%, 6.4%, 8% respectively

## Using my test mold I call Ernest

I made Ernest in elastomer which will allow us to make a progression along two axes and to transfer our samples directly to the tile without the intermediary of the brush.

There are several versions of Ernest

3 versions using 13.5 x 15 cm tiles

The cavities are "named" with the same numbering system that I mentioned above

A 5x5 version 5 rows of 5 cavities each measuring approximately 4.4 cm². This gives good visibility of the test (good for most classic enamels) and small step progressions

A 3x3 version which only includes 9 boxes of 16 cm² and which is intended for overlays and enamels with significant effects

A 4x4 version boxes which have an intermediate size between 3x3 and 5x5, 9 cm² per box. This Ernest there, I use it more and more In internship I now only use this one.

A small 4x4 version

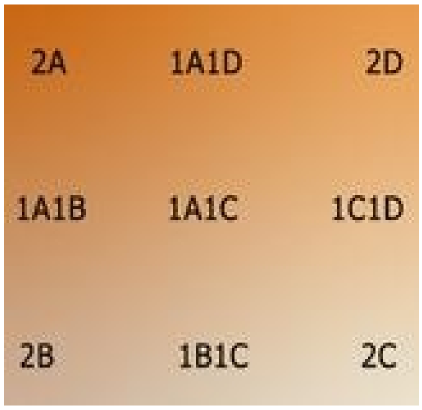
The squares are the same size as the 5x5, but are used with a smaller 11x11.5 tile. These tiles take up less space in the oven and are more easily fired vertically.

**The corresponding numbering**

**for the 3x3 on Ernest**

**on the tile**

| | | |
|---|---|---|
| 2D | 1A 1D | 2A |
| 1C 1D | 1A 1C | 1A 1B |
| 2C | 1B 1C | 2B |




**For the 4x4**

| | | | |
|---|---|---|---|
| 3D | 1A 2D | 2A 1D | 3A |
| 1C 2D | 1B 2D | 1A 1B 1D | 2A 1B |
| 2C1D | 1B 1C 1D | 2B 1D | 1A 2B |
| 3C | 1B 2C | 2B 1C | 3B |


**For the 5x5**

| | | | | |
|---|---|---|---|---|
| 4D | 1A3D | 2A2D | 3A1D | 4A |
| 1C3D | 1B3D | 1A1B2D | 2A1B1D | 3A1D |
| 2C2D | 1B1C2D | 2B2D | 1A2B1D | 2A2B |
| 3C1D | 1B2C1D | 2B1C1D | 3B1D | 1A3B |
| 4C | 1B3C | 2B2C | 3B1C | 4B |


**It may seem weird that in the top row, the D is on the left and the A is due to the reversal**

## First step with Ernest

**In order not to have unpleasant surprises due to improper use, I urge you to follow these tips for the first use of Ernest If you have an Ernest 5x5 you follow the instructions as they are otherwise you have to change the dilutions see below**

### First of all a first test to see what gives a given thickness in practice.

**We will do a simple test of 10 g For example 9 g of syenite and 1 of kaolin which will be diluted in 16 g of water. We will use a single line of Ernest the one that goes from 4A to 4B (This test can be fired to see the influence of the thickness of an enamel on its rendering)**

**In box 4A we will put 0.6 ml of our mixture which gives approximately 0.3 g of dry matter In box 3A1B we will put 0.8 ml of our mixture 0.4 g In box 2A2B we will put 1 ml of our mixture 0.5 g In box 1A3B we will put 1.2 ml of our mixture 0.6 g In box 4B we will put 1.6 ml of our mixture 0.8 g**

**Approximately 0.5ml to 1ml of water is added in each box and the procedure is as explained previously.**

**Of two things, one or everything went well and we have 5 tests of 5 different thicknesses or it has leaked everywhere (case where the tile is not flat, Ernest not pressed enough on the tile because we forgot foam tip or too diluted) or it is not uniform (not sufficiently diluted).**

**If we have done everything correctly we will have the quantities indicated in Red by box**

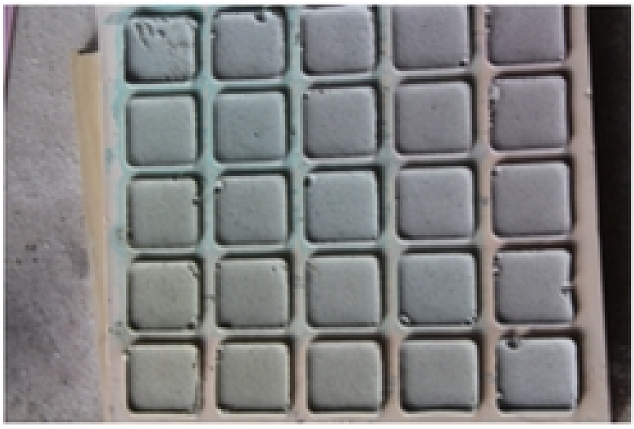
**Once we have successfully passed the first test, we can move on to the second or make a color chart (see below in this document)**

### Second test to train (additions in dry).

**We are going to make a progression in two directions. It is a classic of enamel research which consists of taking a base and gradually adding silica in one direction and kaolin in the other. We will start with a simple recipe so that it is quickly weighed. For example a base with three or four components. We will make 20 g of this base in a plastic glass which we note B to which we add 32g of water (in the case of 5x5). We will put a quarter of this preparation (20 + 32): 4 or 13g in a glass A (it must be borne in mind that, given the dilution, these 13g of liquid glaze corresponds to 5 g of dry glaze ) which is completed with 0.5 g of 10% kaolin. The same for C where we put 1g of silica (20%) and in D where we put 0.5 of kaolin and 1 of silica. If you have food coloring at your disposal, which is not essential but desirable, you can use it to color A, B, C and D differently, it looks nice and it has no effect on the result. This way we can see immediately if we have forgotten an element in a box.**





**We put Ernest (here it's a 5x5) on his board and his piece of foam With a 1 ml syringe we distribute in Ernest starting by putting the A we take as dose 0.2ml In box 4A we put 4 doses of A or 0.8ml, in the adjacent box 3A1D we put 3 doses of A or 0.6ml etc etc. lose). We continue with the B. We can use a cache that we advance line by line as the filling.**

**When Ernest is full we add + or - 0.5 ml of water per cell. This addition allows the glaze to deposit well on the tile, but you have to be careful if you use a little absorbent stoneware to perhaps reduce this amount. We prepare our tile by noting the basic recipe, the additions and the thickness here we have 0.4g per square as the square for a 5x5 is about 4 cm² this gives an enamel at 10g per dm²… .. We cover Ernest with 'a little rigid plastic (like radio of your knee or pastry mat) + a plate of "wood" We tighten a little, we shake so that it mixes in the boxes. We replace our plastic plate by the tile We put a foam plate and the**

planchette we return we shake and we wait. We see depressions forming on Ernest's back. When Ernest is flat again, it can be removed with a little care so as not to damage the tests.

All you have to do is put in the oven… ..

Note with this method of doing only one weighing for the base and making additions in dry to have A, Cet D, it is necessary that the additions remain low. Otherwise not only do we modify the thickness of A, C and D with respect to B but this can also become unmanageable because if we want to add 5 g of silica and 5 g of kaolin to our base of 10 g diluted to 16 g for having D, D will be too thick for syringe dosing. In the case of a large addition, it is therefore necessary to make 4 weighings for A, B, C and D or additions in diluted form. We will see the diluted additions below

## Example of possible progressions

We could, for example, put a celadon in box A, an iron red in B, a magnesium white in C and a geranium ash glaze in D but the results, perhaps moreover very interesting, would be difficult to interpret. We will make more orthodox and above all more useful progressions of the type for example silica-kaolin, silica-boron, phosphate of lime iron

### First method adapted to small additions (dry additions)

We take a base B which we divide into 4 equal parts. Silica is added, for example 10%, in C, 5% of titanium, in D 10% of Si and 5 of Ti, and for B, nothing is added. line by putting for example in the box 2B1C1D 2 doses of B, one of C and one of D etc

| | | | | |
|---|---|---|---|---|
| 4D | 1A3D | 2A2D | 3A1D | 4A |
| 1C3D | 1B3D | 1A1B2D | 2A1B1D | 3A1D |
| 2C2D | 1B1C2D | 2B2D | 1A2B1D | 2A2B |
| 3C1D | 1B2C1D | 2B1C1D | 3B1D | 1A3B |
| 4C | 1B3C | 2B2C | 3B1C | 4B |

Increase of silica

Increase in titanium

## Second method replacing one material with another

In an glaze, it is possible to envisage replacing one frit by another with a variation on the silica. We make recipe B with one of the two frits and recipe C with the other. B it is divided into two wells A and B; in A we add 15% of Si. We proceed in the same way for C and D. We end up with 4 wells A, B, C and D and we proceed as before

## Third method wet additions

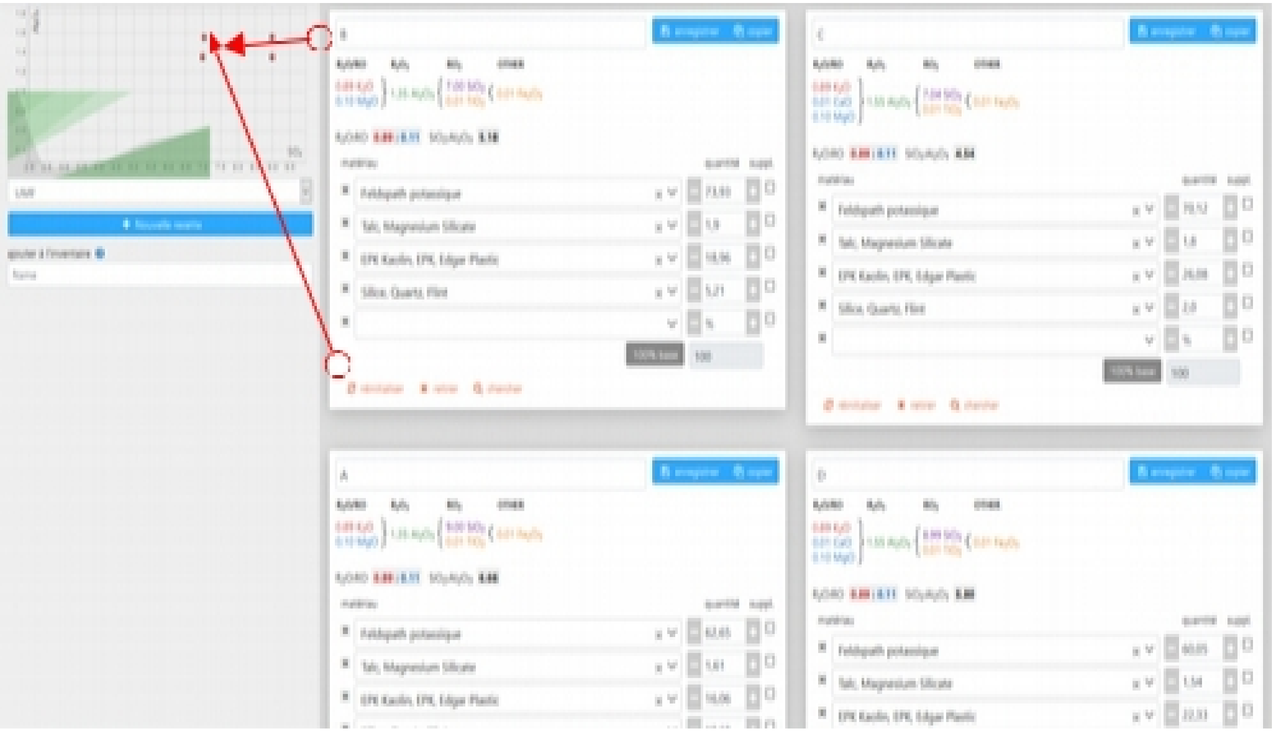
We have seen with the dry additions that we could not add more than 10 or 20% DM in wells A, C or D because we then lost precision and if we add a large amount of DM we could quickly get something mushy that can't be used. But we can add our diluted AC and D materials in the same way as the base. The difficulty then being to calculate the recipe of the mixture I made a calculator which makes it possible to make this calculation easily. Here is the link with the video of this method [https://youtu.be/ ZnbLfd311_E](https://youtu.be/ZnbLfd311_E)

This method is new to me, it seems that having done the " calculette-ernest " opens up interesting new possibilities. For example, going through a diagram becomes very easy: all you have to do is make a base of the diagram and add silica diluted in one direction and alumina in the other.

## Fourth method exploring a diagram

You may also want to explore an area of a given diagram. For example in the diagram of the book of Daniel de Montmollin (Potter, monk, French writer) ( the diagram "59" (0.1 MgO 0.9 KNaO) we can vary the alumina between 1.35 and 1.55 and the silica between 7 and 9. For the calculations we will use Glazy We determine our

**We copy our recipe 3 times. first copy we adjust the silica to find it at 9, on the 2th we adjust the alumina to put it at 1.55, on the third copy we will adjust to have both 1.55 alumina and 9 silica. We click on the% button so that our 4 recipes are found on 100 (this way it will be easier to make 10gr of each). Below is the screenshot of his 4 recipes Note the silica alumina axes are reversed at Montmollin compared to Glazy diagram of Stull**



**We weigh each of the recipes for 10g (5g if you have a sufficiently precise scale). And we operate like the previous cases**

## 5 method: search from a given recipe

**Here is a recipe for a black given by Charles Hair. He tells us to cook at 1280 ° C in reduction. You should know that a recipe must always be adapted to its own cooking, its materials, etc.**

**result is not there…. So we will explore an area around the recipe of Charles Hair. The initial recipe is as follows**

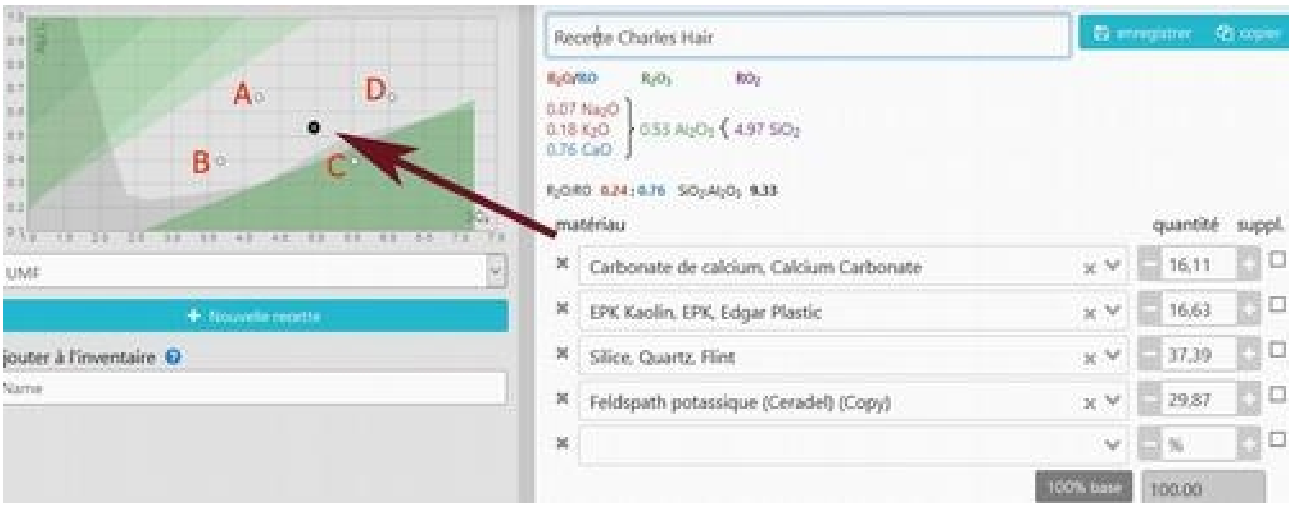
**Potassium feldspar 29.87 Chalk 16.11 Kaolin 16.63 Silica 37.39 supplemented with 8% iron, 1% chromium, 3% manganese**

**This gives by simplifying a little for about twenty grams**

**4 kaolin, 9 silica, 4 withing, 7.5 feldspar, 0.25 chromium, 2 iron, 0.75 manganese**

**We will vary the kaolin and silica to revolve around this recipe**

**For that we will pass the kaolin from 2 to 6 and the silica from 6 to 12 Which gives in a Stull diagram**




**We therefore prepare our base B which is**

**kaolin 2 silica 6 chalk 4 feldspar 7.5 chromium 0.25 iron 2 manganese 0.75 which is diluted with 26.4 g of water to obtain the desired thickness. We stir. We divide into 4 buckets ... in B we add nothing; in C 1.5 silica (6/4) is added; in A 1 of kaolin (4/4) and in D, 1 of kaolin and 1.5 of silica are added. We operate as usual to fill Ernest (0.8 ml per compartment) and this gives this after cooking**

**From my point of view the best zone for my materials and my cooking is towards the 2 nd row 2 nd column which is the recipe with 5 of kaolin and 7.5 of silica and not the center which was the initial recipe. You should now refine the search by zooming in on this area. For example, kaolin can be varied from 4.5 to 5.5 and silica from 7 to 9**

# Dilution

**Water with this method plays an important role as it determines the thickness of enamel on our sample. All you have to do is play on the amount of water that will be added to the dry matter (DM), on the volume that will be placed in each box of our "Ernest" and of course the Ernest model, but don't worry. I have already done the calculations for you… ..**

**We will want to put a certain thickness of enamel to make our samples, which is equivalent to saying that we want a certain weight per cm$^2$ of glaze. The problem is that some families of glaze require to be laid thicker than others so with a greater weight per cm$^2$ How do you know? You have to try because the mentions that we see lying around in books like the glaze must have a creme fraiche or pancake batter consistency are vague and unusable. I prefer to speak of gram per $cm_2$ and for example a current glaze could be tested at 0.1g per cm$^2$ at first. This will give a thickness (when dipping glaze) of approximately 0.4 mm For those who are bored with the calculation: you skip the following paragraph**

**Knowing that most of the materials used (silica, kaolin, dolomite, lime, feldspar) in an glaze have a density of about 2.5 or 2.5 g per ml If we put a weight P of our dry matter in a volume $V_{water}$ (volume of water) we will obtain a $V_{E\text{-}mail}$ (glaze volume) which will be $V_{water}$+ (P / 2.5). Knowing also that to measure our volume of glaze it is simpler to use the graduations of 0.2 in 0.2 for the 1 ml syringe we will make tests to have boxes containing 0.8ml of diluted enamel You follow? So 0.4gr corresponding to 0.8ml, 10gr of DM correspond to 20 ml and 10 g of DM making 4 ml to our
10 g of DM we will add 20-4 ml of water or 16 g**

For a common glaze we can use a dilution

1.6g of water for 1g of DM for 5x5 with the dose at 0.2ml (0.8ml per box)

1.4g of water for 1g of DM for the large 4x4 with a dose of 0.5ml (1.5ml per box) 1.6g of water for 1g of DM for the small 4x4 with a dose of 0.3ml (0.9ml per compartment) of 1.6g of water for 1g of DM for the 3x3 with a dose of 1.5ml (3ml per compartment)

When we have diluted our enamel correctly, it suffices to take out the appropriate syringe and fill in our boxes as indicated on each box… .. once the box is full, we turn it over on the tile and we note on the back of the tile the 4 recipes A, B, C and D all you have to do is cook.

In practice, to improve the distribution of our glaze on the tile, an additional dilution of the glaze facilitates its turning. We can put between 0.5 ml and 1 ml per box (at this level the precision does not matter because it is not the additional water which changes the quantity of dry matter deposited). This addition should not be exaggerated either because the enamel must not take too long to dry on the tile (see note on poorly absorbent sandstone). a wooden plate or on another sample tile prevents any leaks when turning because this absorbs the warping-like defects of your tile.

In the example above we wanted 0.4 g of DM per box with a volume of 0.8 ml of enamel per box (i.e. doses of 0.2 ml) but we may want to make a more or less thick glaze So here is a table that relates the weight of dry matter to the dilution. For example, if we want a thinner glaze at 0.3 g per box, we will dilute our 10g of DM with 23g of water and we will make doses of 0.2 ml or 0.8ml per box. If we want 0.8 g per compartment, we will dilute it to 11g of water for 10 DM and we will take a dose of 0.3 ml (and not 0.2) to have 1.2 ml per compartment. For even greater thicknesses, doses of 0.5 ml etc. will be made, etc. Initially, except in particular glaze, only the 0.4 line can be used. Lines 0.9 to 1,

| MS In gr | V in ml | Water for 10gr | V in ml | Water for 10gr | V in ml | Water for 10gr |
|---|---|---|---|---|---|---|
| 0.3 | 0.8 | 23 | | | | |
| 0.4 | 0.8 | 16 | | | | |
| 0.5 | 0.8 | 12 | | | | |
| 0.6 | 0.8 | 9 | 1.2 | 16 | | |
| 0.7 | | | 1.2 | 13 | | |
| 0.8 | | | 1.2 | 11 | 2 | 21 |
| 0.9 | | | 1.2 | 9 | 2 | 18 |
| 1 | | | | | 2 | 16 |
| 1.2 | | | | | 2 | 13 |
| 1.4 | | | | | 2 | 10 |

**For Ernest 3x3**

**In most cases, tests of 3ml per compartment will be carried out, which gives, for a thickness corresponding to 8g per dm², a dilution of 19 g of water for 10 g of DM.**

**For Ernest 4x4 small format**

**If we do tests with 0.9 ml per box (dose at 0.3ml) (1ml syringe) we can use a dilution of 10 MS for 16 water which will suit most enamels.**

**For Ernest 4x4 large format**

**We will do tests with 1.5 ml per box (0.5ml dose) (3ml syringe) we can use a dilution of 10 DM to 14 water which will suit most glazes. There is a checklist for this format at the end of the document**

**Color chart**

## Other use of Ernest: color tests with the use of dropper

**We want to do color tests with oxide or dye in a given glaze. When an enamel base is developed, its color can be declined by adding coloring oxides, combinations of oxides or materials that are added in small quantities such as titanium or tin. As these are small quantities, we will do it in small quantities.**

**I made two videos of this method https://youtu.be/NUAIc5UCCm4**

**Where https://youtu.be/oBDNR5ujJQM**


**The principle for making this color chart is to put the same amount of liquid enamel in each Ernest box and add oxide dropwise. The dilution of our oxide in the dropper is calculated so that a drop corresponds to 1% (or less depending on the oxides) of the dry matter deposited in each box. Obviously you have to do some small preliminary calculations to calculate this dilution. This calculation is based on the fact that it takes 20 drops of water to make 1 g or 1 ml. We dilute our oxide so much that we will admit that this is not modified when we add the oxide.**

### Dilution of oxides in the droppers

**For the 5x5 or the small 4x4 if our glaze has been prepared at 10g of DM for 16 of water and that we put 0.8ml per compartment, we therefore have 0.4 g of DM per compartment. In this case if we dilute 0.8 g of oxide in 10 ml of water in the dropper, an addition drop in a box will correspond to 1%. For cobalt, for example 0.2 g per 10 ml will be further diluted so as to have 0.25% per drop. We can add a point of bentonite in the mixture so that it remains better in suspension. In any case, it will be advisable to shake the dropper often when making a color chart.**

**For the large-format 4x4 with a dilution of 1 MS for 1.4 g of water, the oxide will be diluted to 1.7g for 10ml**

**A video [https://youtu.be/oBDNR5ujJQM](https://youtu.be/oBDNR5ujJQM)**

### Using Ernest for Overlays

### Corresponding video

https://www.youtube.com/watch?v=1XqzZRYvOzE

**For the overlays we will preferably use Ernest 3x3 to have more visibility. We fill our 3x3 boxes with 9 different enamels or a progression and we 'print' several tiles on which we will apply an enamel by spraying or dipping. This method is quite fast but the result, like any test carried out in any other way, will have to be interpreted with caution because the respective thicknesses of each enamel are estimated “with a wet finger”.**

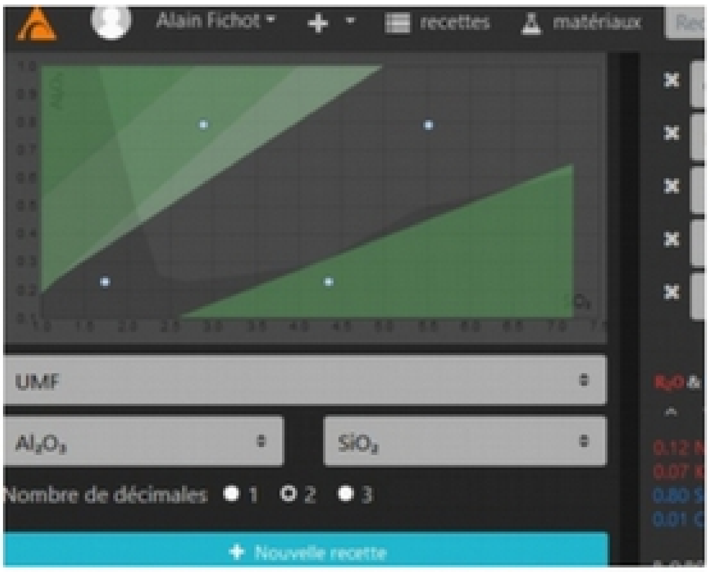
**Corresponding video https://youtu.be/ioF8K5IXt-A**

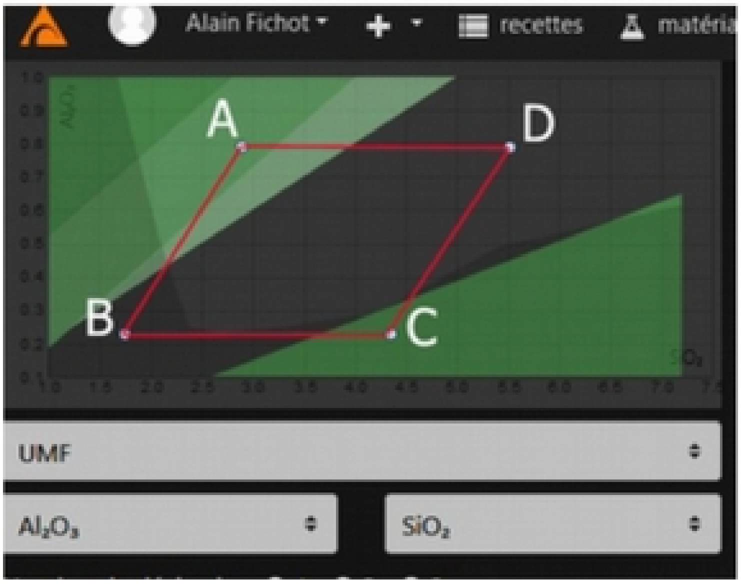
## Progress along two axes: Ernest and Glazy differences and commonalities.

**Here is a detailed research with a material on which we want to make significant progress, for example here I wanted to test strontium by covering a large area. We will take the opportunity to see the differences between the Ernest method and the method that I will call method Glazy and we will do it on this example**

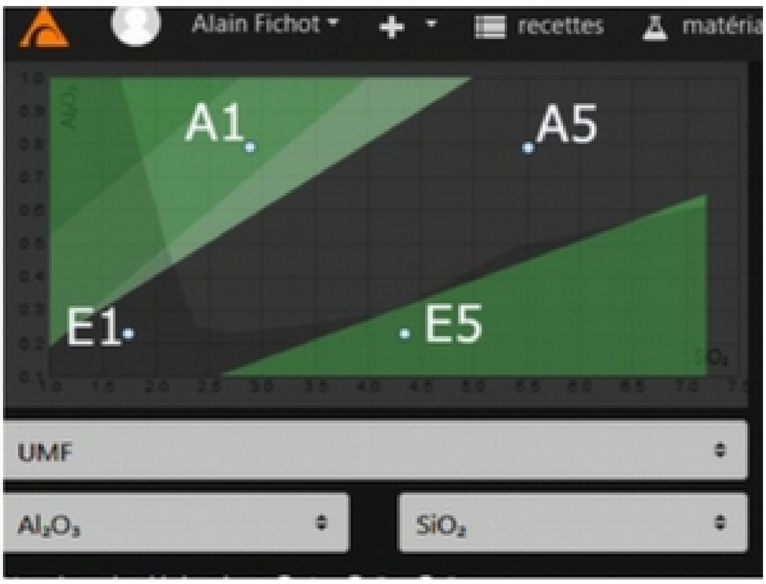
**The recipe will be a mixture of feldspar, strontium carbonate, silica and kaolin. And we will stay in the diagram 0.2 NaKO 0.8 SrO… .Silica… .Al2O3**

**We will calculate 4 recipes to define these 4 points of the diagram which for Ernest will be called A, B, C and D and for Glazy A1, A5, E1 and E5**




**ERNEST**




**GLAZY**

The 4 recipes

| | Strontium | Feldspar | Silica | Kaolin |
|---|---|---|---|---|
| A or A1 | 28 | 35 | 0 | 37 |
| B or E1 | 45 | 55 | 0 | 0 |
| C or E5 | 28 | 35 | 37 | 0 |
| D or A5 | 20 | 25 | 28 | 27 |

**In molar formula this gives this**

| | | Al2O3 | SiO2 | |
|---|---|---|---|---|
| A or A1 | 0.8 SrO 0.2 NaKO | 0.8 | 2.8 | |
| B or E1 | 0.8 SrO 0.2 NaKO | 0.23 | 1.75 | |
| C or E5 | 0.8 SrO 0.2 NaKO | 0.23 | 4.3 | |
| D or A5 | 0.8 SrO 0.2 NaKO | 0.8 | 5.5 | |

**Recipes presented on Glazy**

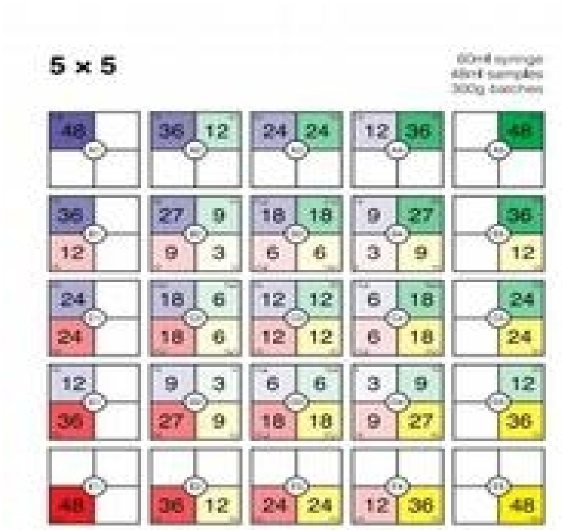

**This is where the Ernest method differs from**

**Glazy's GLAZY progression**

**To make a progression in 2 directions, the first idea that comes is to progress in a linear fashion in these two directions. This is what it gives when the sum of each box is 48 (in each box we put 48 "doses"). If we take a box for example the box of the 2nd row 2nd column called B2 we have**

**27 of A (A1) 9 of B (E1) 3 of C (E5) and 9 of D (A5) We**

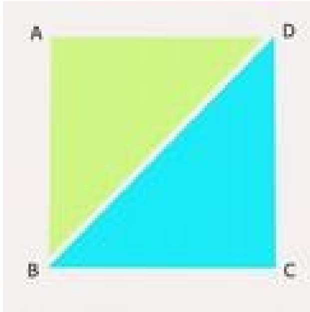
**see that on the periphery we have a mixture of two**



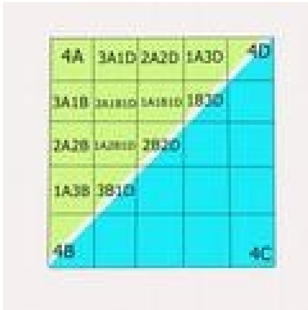
components but on the interiors we have the 4 components.
This solution is nice on the other hand I did not choose it for Ernest because from my point of view there is simpler, less material consumer and especially faster to carry out the tests.

## Progression Ernest

This progression is based on the fact that a square is formed by two triangles which would have a common side and in each triangle, we can make a triangular progression.




Here is the progression on the first triangle

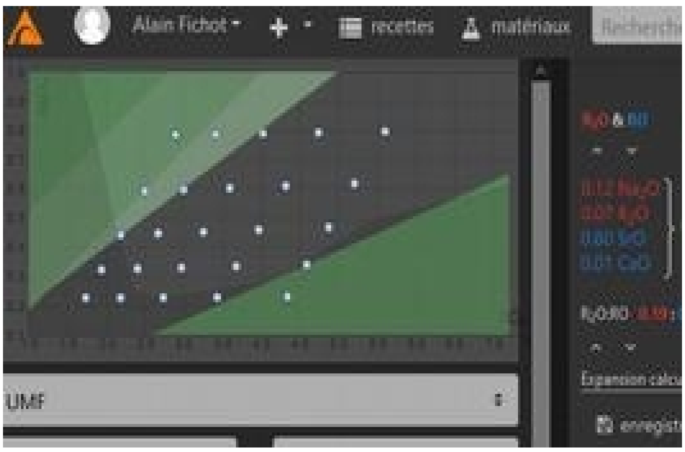



And the whole gives this:


We can notice that there is at most 3 components per box. For a given box we will put the components as indicated. For example in box 2A1B1D we will put 2 doses of A, 1 of B and 1 of C

It remains to be seen if the simplicity of this progression hinders the search for the enamel of your dreams.

In Glazy, by clicking on the biaxial mixing function 5 lines 5 columns with the 4 recipes defined previously, we obtain the 25 points on the diagram. These points are distributed with a density which decreases from top to bottom and from left to right.
Glazy gives the 25 recipes and molar formulas at the same time which is practical!

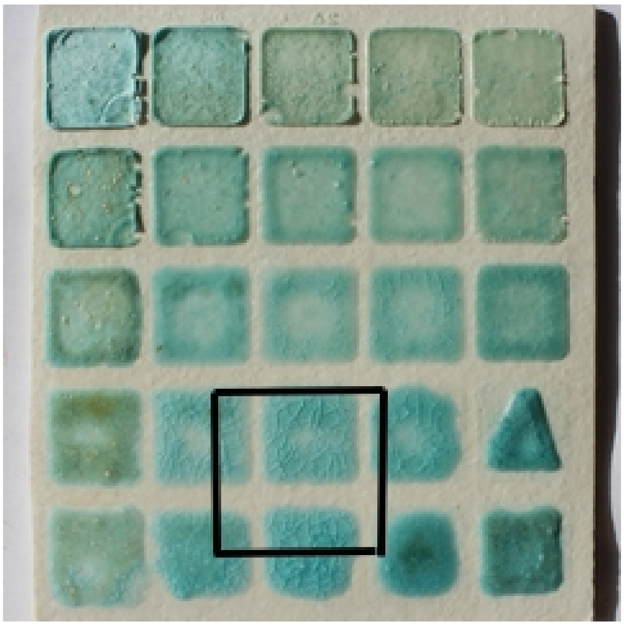


**Now if we introduce each recipe defined by the different Ernest mixes in Glazy, we get this distribution in the Stull diagram**
**The difference is important, but is it fundamental?**
**To better visualize a little color The red dots at the periphery are unchanged The inner dots change from the blue position to the yellow position.**


**Using Ernest to Make Glaz Progressions**

**For enamel researchers who think this difference is too big there is a solution to using Ernest while doing Glazy progressions. It's longer but not impossible**
**Once the 4 recipes have been weighed and diluted in the same way (we will call them A1, A5, E1 and E5) We will start by carrying out the series of A and that of E by dosing in volume. For example A4 is the mixture of 1 dose of A1 for 3 doses of A5. Once we have the 2 lines of A and E we will make the different columns by mixing in volume, i.e. in Ernest's box which is the second row 4 th column it will be necessary to put B2 because as Ernest turns around on the tile, what is on the left is found on the right. B2 is a mixture of A2 and E2 (3 doses of A2 and 1 dose of E2). I could make Ernest with the numbered squares like Glazy but I find the game not worth the effort. The downside is that Glazy only calculates recipes for Glazy progressions and not yet for Ernest progressions… .. https://youtu.be/d8mpiogJULA**

## Result of this progression



**The progressions are quite clear**
**The blue color is not surprising in this kind of base From my point of view it would be necessary to rework around the 1A 2B 1D For this we calculate its recipe:**

| | Strontium | Feldspar | Silica | Kaolin |
|---|---|---|---|---|
| AT | 1x28 | 1x35 | 1x0 | 1x37 |
| B (x2) | 2x45 | 2x55 | 2x0 | 2x0 |
| VS | 0x28 | 0x35 | 0x37 | 0x0 |
| D | 1x20 | 1x25 | 1x28 | 1x27 |
| 1A2B1D | 138 | 170 | 28 | 64 |
| 1A2B1D | 34.5 | 42.5 | 7 | 16 |

### We can calculate its molar formula if we like

**0.8 SrO 0.2 $K_2O$ 0.44$Al_2O_3$ 2.57 $SiO_2$**

**To refine this research, we will repeat a test by varying $Al_2O_3$ between 0.4 and 0.5 and $SiO_2$ between 2.2 and 2.9**

**After 3 tries. we have the following final recipe 38 of strontium carb, 46 of feldspar, 19 of kaolin, 10 of silica and 1.5 of copper carb to have green blue We can put the recipe for 100g but that makes lengthy numbers for minimal interest.**

**Preparing the tiles**

https://www.youtube.com/watch?v=7AZ8RsTJjmU

**The tiles will be 14.5 cm by 16 cm for the Ernest 3x3 the 5x5 and the large 4x4 (for the Ernest 4x4 small format the tiles are 11x12). They should be made with the soil you usually use. You can sink them, which is the easiest. Personally I run several at the same time on a plaster tile (66x50x5cm kind that one finds at the merchants of materials) they are cut when they have a leather consistency. If you do them with a roller or with a crusting machine, it is advisable to erase the traces of the canvas if they are too marked). It is also better to do them by several to limit any warping and cut them when they are very firm. For biscuit baking you can bake them vertically.**

**For enamel firing, if your tiles are porcelain and subject to deformation, they can be fired horizontally or resting on a kind of easel which allows you to see if your enamel is flowing. Personally I cook them slightly inclined (about twenty degrees) which allows to see if the enamel has a tendency to flow by examining the bead it makes at the bottom of the test.**

## Note on volume dosing and relative approximaions of this “weighing” mode

**Some readers will say that I have it all wrong because I neglect the change in volume due to the addition of dry matter with my method in glasses A, C and D (for the method where we make a basic recipe and the other corners Ernest being made by addition.) But if this addition is small, the error produced is tiny and in any case less than the errors inherent in the relative precision of the use of the syringe. So the addition of material to recipe B to have recipes A This D will be done with a maximum of twenty% to limit this error to reasonable values. The relative accuracy of this method is largely outweighed by its speed of execution. If you are interested in this precision, know that a volume measured with a 1 ml syringe will be estimated at less than 0.03 ml. I'll leave it to you to finish the error calculation and compare it to using a balance. I therefore proceed differently than the Ian Currie method which adapts the addition of water in the buckets to have the same volumes which gives a correct calculation in theory but in practice the adjustment to have the same volumes is imprecise and is therefore a source error. For nit-pickers here is the little calculation that justifies this approximation. The others can go to the next paragraph Either a base B of 10 g of dry matter which is diluted with 16 g of water, if we estimate that the average density of our dry matter is 2.5 we have the volume of B which makes 16 ml of water + 10/2, 5 ml of dry matter is 20 ml This volume is divided into two 10 ml cups In well A we add 20% of silica relative to the dry matter which is 5 gr (10/2) so we add 1 g of silica whose density is 2.2 so we add a volume of silica of 1 divided by 2.2 or 0.45 ml so we have a cup B which is 10 ml and A 10.45 ml If we take 4 ml in well B and 4 ml in well A we will have ,(5/10) x4 gr of DM provided by B and (5 / 10.45) x4 gr of DM provided by B, i.e. 3.91 gr of DM and 1 / 10.45 x4 which is equal to 0.38 gr When we make the ratio that interests us, i.e. how much silica we added to our base (0.38 / 3.91) in percentage we get 9 , 7% instead of 10%. We see that the approximation is justified 2 so we add a volume of silica of 1 divided by 2.2 or 0.45 ml so we have a cup B which is 10 ml and the A 10.45 ml If we take 4 ml in well B and 4 ml in in cup A we will have ,(5/10) x4 gr of DM provided by B and (5 / 10.45) x4 gr of DM provided by B i.e. 3.91 gr of DM and 1 /**

**10.45 x4 which is equal to 0.38 gr When we make the ratio that interests us, i.e. how much silica we added to our base (0.38 / 3.91) as a percentage we obtain 9.7% instead of 10% . We see that the approximation is justified 2 so we add a volume of silica of 1 divided by 2.2 or 0.45 ml so we have a cup B which is 10 ml and the A 10.45 ml If we take 4 ml in well B and 4 ml in in cup A we will have ,(5/10) x4 gr of DM provided by B and (5 / 10.45) x4 gr of DM provided by B i.e. 3.91 gr of DM and 1 / 10.45 x4 which is equal to 0.38 gr When we make the ratio that interests us, i.e. how much silica we added to our base (0.38 / 3.91) as a percentage we obtain 9.7% instead of 10% . We see that the approximation is justified 38 gr When we make the report that interests us, ie how much silica we added to our base (0.38 / 3.91) as a percentage we obtain 9.7% instead of 10%. We see that the approximation is justified 38 gr When we make the report that interests us, ie how much silica we added to our base (0.38 / 3.91) as a percentage we obtain 9.7% instead of 10%. We see that the approximation is justified**

**The other error comes from the fact that glaze is a suspension of different solids and not a solution and that this suspension tends to lead. This is true, but in ceramics we always have to deal with suspensions and never with solutions. Ceramists are accustomed to working with frequent stirring of the preparation or adding suspensions to the preparation. In any case, when we do an glaze search we proceed by successive zooms which increases the precision as we approach the ,'perfect' glaze**

## As a conclusion

**My research method is close to other methods like those of Jean Meissen who “weighed” him down in drops. The drip method is very fast but it has the disadvantage of making samples that are too small for my taste. Ian currie's method is interesting and it is suitable for a systematic search, that is to say a search where we explore a whole diagram. Personally I try to limit my search field. For example, I never look for glazes with less than 1.5 moles of silica for reasons of mechanical and chemical stability of the baked enamel. On the other hand, I limit my research to enamels which will have a good melting point, that is to say that their theoretical melting temperature calculated for example with online-glaze-calculator is close to my firing temperature.**

**The search for glaze is a bit like the search for mushrooms for example if I want to look for porcini mushrooms in my village which is 50 km ² I can consider crisscrossing the entire territory of the municipality passing every 10 meters. It's 5000 km to cover ... it's a lot on foot. So I add a criterion: the porcini grows in the woods ... immediately we only have 2000 km to walk and as I don't want to go to the Douglas forests, I just have to to do 500 km. We can add other criteria, for example not to go to places where everyone goes! ...**

**In short, the search for glaze is vast and I wish you great discoveries**

**End of this part**

## Checklist for the large 4x4 case 9 cm²

**Quantity to obtain a standard enamel thickness of 9 g per dm² (i.e. 0.83 g per box)**

**Note the recipe and its additions on a tile (ceramic pencil)**

**Prepare about 25g of base**

**Add the water proportion 14 g of water for 10 g of DM**

**Divide into equal parts in the 4 cups A, B, C and D**

**Make the additions in A, C and D**

**Stir**

**Place Ernest on plate and foam**

**With a 3 ml syringe, distribute the 0.5 ml unit (1.5 ml per compartment) Add water in each compartment (to be adapted according to the soil approximately 1 ml)**

**Cover, shake while tightening**

**Replace the film with the tile Cover with the foam and a plate Tighten, turn over, shake, put on, wait Remove Ernest**

**Color chart**

## Dilution of oxides in the dropper

**For a dilution of 10g of enamel MS in 14g of water and a quantity of 1.5ml per box, the oxides will be diluted in the dropper 0.17g of oxide for 1ml of water which will give 1% per drop**

## Checklist for the small 4x4 case 4.4 cm²

**Quantity to obtain a standard enamel thickness of 10g per dm² (i.e. 0.45g per box)**

**Note the recipe and its additions on the tile (ceramic pencil)**

**Prepare about 15g of base**

**Add the water proportion 16 g of water for 10 g of DM**

**Divide into equal parts in the 4 cups A, B, C and D**

**Make the additions in A, C and D**

## Stir

**Place Ernest on plate and foam**

**With a 1 ml syringe, divide the unit 0.3 ml (0.9 ml per compartment) Add water to each compartment (to be adapted according to soil)**

**Cover, shake by tightening Replace the film with the tile Cover with the foam and a plate Tighten, turn over, shake, put down, wait Remove Ernest**

**Color chart**

## Dilution of oxides in the dropper

**For a dilution of 10g of enamel MS in 16g of water and a quantity of 0.9ml per box, the oxides will be diluted in the dropper 0.09g of oxide for 1ml of water which will give 1% per drop**