CLAIMS

1. A process for alkylating an aromatic amine comprising:
    a) loading a fixed bed reactor with a bentonite acidic clay,
    b) heating or cooling the reactor to within a selected temperature range of from 140°C to 180°C,
    c) passing through the acidic bentonite clay in the fixed bed reactor a liquid mixture comprising one or more olefins selected from pentene, hexene, octene, nonene, a mixture of nonenes, decene, undecene, dodecene, tetradecene, hexadecene, and octadecene, and an aromatic amine of formula:

$$ArNH_2,\ Ar_2NH,\ Ar_3N \text{ or } R_2N\text{-}Ar\text{-}NR_2,$$

    wherein each Ar is independently selected from the group consisting of phenyl, phenyl substituted by $C_{1\text{-}18}$ alkyl, naphthyl, and naphthyl substituted by $C_{1\text{-}18}$ alkyl; and
    each R is independently selected from the group consisting of H, $C_{1\text{-}18}$ alkyl, phenyl, phenyl substituted by $C_{1\text{-}18}$ alkyl, naphthyl, and naphthyl substituted by $C_{1\text{-}18}$ alkyl;
    to yield a product wherein one or more of the groups Ar are alkylated by one or more alkyl groups derived from the olefin;
    wherein the reaction pressure is below 250 psi (1.7 MPa).

2. The process according to claim 1 wherein the aromatic amine is of the formula Ar_2NH.

3. The process according to claim 2 wherein the aromatic amine is diphenylamine, dinaphthylamine or N-phenyl-N-naphthyl amine.

4. The process according to claim 1 wherein the one or more olefins comprises hexene, octene, nonene, a mixture of nonenes, decene, undecene, dodecene, tetradecene, hexadecene, and octadecene.

5. The process according to claim 1 wherein the one or more olefins comprise tri-isobutylene, di-propylene, tri-propylene or tetra-propylene.

6. The process according to claim 1 wherein the acidic clay is bentonite F-24, F-24X or FULCAT 22B clay.

7. The process according to claim 1 wherein the one or more olefins and the aromatic amine are mixed together before being introduced to the fixed bed reactor through the same feed.

8. The process according to claim 1 wherein the one or more olefins and the aromatic amine are introduced to the fixed bed reactor separately through different feeds.

9. The process according to claim 7 wherein the one or more olefins and the aromatic amine are mixed together in a vessel and heated at temperatures of from 40°C up to the first selected reaction temperature before being introduced to the fixed bed reactor.

10. The process according to claim 1 wherein the mole ratio of the one or more olefins to the aromatic amine is from 2:1 to 4:1.

11. The process according to claim 1 wherein the aromatic amine has a formula Ar_2NH wherein each Ar is independently selected from the group consisting of phenyl and naphthyl.

12. The process according to claim 11 wherein the product comprises:
    less than 1% by weight of starting aromatic amine, based on all aromatic amines present,
    15% to 35% of mono-alkylated aromatic amine;
    55% to 80% di-alkylated aromatic amine; and
    0.5 to 15% of tri-alkylated aromatic amine.

13. The process according to claim 12 wherein the olefin is selected from the group consisting of nonenes, decene and dodecene and the product is a liquid at room temperature.

14. The process according to claim 1, wherein the mixture comprising one or more olefins and aromatic amine are passed through the clay filled reactor bed or beds at the reaction temperature, the product mixture is collected at elevated temperature while excess olefin is continuously stripped out.

15. The process according to claim 14 wherein the excess olefin is continuously stripped out and fed back into the reactor.

16. The process according to claim 14 wherein the reactors are tubes of shell and tube heat exchangers filled with the catalyst where the shell is used to maintain temperature control of the reaction mixture.

17. The process according to claim 16, wherein the reaction product is fed through heat exchanges as heat exchanger fluid.